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SOME MATHEMATICAL ASPECTS OF THE BINET-SIMON TESTS

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Since the Binet-Simon Scale for Measuring the Intelligence of Young Children was first issued, a number of translations into other languages with necessary adaptations of tests have been made and these have been followed by various revisions. These adhere in their main features and plan to the original idea of Binet and Simon.

This was to set tests for different age levels and, by observing the child's successes and failures, to give him a net score for the series which has been called the child's "Mental Age." This score has been taken as an index of the child's intelligence or intellectual status; and comparison of this score with his "Chronological Age" has been used as diagnostic of feeble-mindedness, mental normality, or mental precocity.

The Goddard revision (1911) of the Binet-Simon scale (3)[1] has been used more extensively than any other in this country and may be taken as typical. Five tests are set for each level from 3 to 12 inclusive; and standards for giving these and for scoring success or failure have been more or less definitely worked out. A child is credited with a "basal age" of the highest year for which he passes all the tests. To determine his mental age one year is added for each five tests passed from the higher age levels.

Ideally, mentally normal children of a given chronological age should make a mean mental age score which is approximately equal to their chronological age. It was soon observed by those who used the Binet-Simon Scale in its earlier form that the results obtained were not equally satisfactory for normal chil-

[1] The figures in parenthesis refer to the bibliography at the end of the article.

dren of all ages. Young children tested too high, children over 12 too low, and the best results were obtained for the intermediate ages. In the revisions of the scale which followed various efforts were made to remedy this defect. Tests for other age levels were introduced (11 year tests by Goddard (3) and tests for less than 4 years by Kuhlmann (5)). Certain tests were moved up or down in the scale to different age levels, some new tests were introduced, others discarded, and a stricter technique of giving and scoring the tests was adopted.

Goddard considered the results satisfactory if the mental-age derived was not more than one year above or below the chronological age. By this criterion he considered 78 percent of his results with 1547 children "satisfactory." But his own analysis of these cases (2) showed that these satisfactory results were by no means evenly distributed, as is shown by the following figures:

Chronological Age	4	5	6	7	8	9	10	11	12	All
Number of Cases	8	114	160	197	209	201	222	166	144	1421
Number Satisfactory	5	88	146	179	189	168	170	122	75	1142
Percent Satisfactory	63	77	91	91	90	87	76	73	56	80.4

The percentages of satisfactory cases run high for chronological ages 6 to 9 inclusive but fall off at either end of the age series. Other revisions showed similar though perhaps less striking results.

Still more striking were the results with adults and adolescents. Where these results were obtained from institutional cases they were readily accepted as showing a high frequency of mental deficiency and feeble-mindedness but when rather similar results were obtained from factory operatives and high schools some of the disadvantages of the scales became more apparent. Many who made use of the Binet tests seem to have either ignored these difficulties or to have used a lower "passing mark" in interpreting the scores for diagnostic purposes.

Thorndike (10), working over Goddard's results mentioned above and comparing them with later results of other investigators, pointed out clearly the inequalities of these scales and derived a table of "true mental-ages," in which the latter coincide closely with the Binet test mental age up to ten years. Thenceforward the true mental ages for each Binet score are increasingly advanced, giving 13.8 as the true mental age for a Binet score of 11.8. Too little attention seems to have been given to the

reason for these inequalities which lies in the very nature of the scales. A boy of 7 has, in Goddard's revision, some theoretical chance of passing 25 tests beyond the tests set for the seven year level. A boy of 11, on the other hand, has a chance of passing only 5 tests beyond those set for the eleven year level. It is obvious that, unless these 5 tests are easier for the twelve year old boy than any 5 of the 25 tests are for the seven year old boy, the seven year old boy has the better chance of securing credit for tests above his chronological age.

The Stanford Revision (8), prepared by Prof. Lewis N. Terman of Leland Stanford Jr. University and recently issued, is a serious attempt to overcome some of the chief disadvantages of the earlier revisions. In this series there are six tests set for each year level from 3 to 10 years inclusive. Success in each of these tests above the basal age is counted as two months toward the mental-age score. For 12 years there are eight tests, each counting three months, for 14 six, each counting four months, for 16 and 18 there are in each case six tests counting as five and six months respectively. The method and technique of this revision have been worked out much more carefully and stated more clearly than in any earlier revision.

In interpreting the significance of the mental age scores of children of the same or different ages or of the same child at different ages obtained from this revision the intelligence quotient or ratio of mental age score to chronological age ($\times$ 100) has been found convenient. The mean intelligence quotient of each age group tested by Terman approximates 100. But this scale also in many cases gives too high a mental age score for the very young children and too low a score for those over 12. It is the purpose of this paper to suggest one method of theoretical treatment which should be useful:

1. In comparing the results obtained with children of different ages from any revision and in interpreting the significance of these mental-age scores or intelligence quotients.

2. In comparing the validity of the results obtained by the use of different revisions.

3. In predicting the results which may be expected from still further revision or alteration.

If the individual tests of the Stanford Revision are given to normal seven year children or the so-called unselected[2] children

[2] The definition of "unselected" is uncertain, but this does not affect the argument of this paper.

who are not suspected of marked mental deficiency we find that the average relative frequency with which these children pass these tests begins with a frequency approaching unity for the four year tests and that this percentage decreases steadily for the tests set at higher age levels. If these frequencies are known, it becomes possible to compute the theoretical distribution of basal ages; *i. e.*, to find the probable number who will have a basal age of four years, five years, etc., respectively.

Let us assume for purposes of simplification that this frequency is the same for each of the tests given at any age level (six in the case of the Stanford Revision). The argument remains the same even where they vary considerably. Assume for purposes of argument that the following results are obtained (actual frequencies would have been used but Terman's results had not yet been published when this was written).

Average of relative frequency for each of							4	year tests	.....	0.98
"	"	"	"	"	"	"	5	" "	.....	0.95
"	"	"	"	"	"	"	6	" "	.....	0.85
"	"	"	"	"	"	"	7	" "	.....	0.75
"	"	"	"	"	"	"	8	" "	.....	0.50
"	"	"	"	"	"	"	9	" "	.....	0.30
"	"	"	"	"	"	"	10	" "	.....	0.10
"	"	"	"	"	"	"	12	" "	.....	0.05

The probability of a given seven year old child having a basal age of four years will take into account (1) the probability that he will pass all of the six tests for the fourth year $(0.98)^6$, and (2) the probability that he will not pass all the tests for any subsequent year. The probability that he will not pass all of the five year tests will be $1-(.95)^6$ and so on for the higher years. The probability P_4 that 4 will be his basal age may be computed as follows:

$$P_4 = (.98)^6\,[1-(.95)^6]\,[1-(.85)^6]\,[1-(.75)^6]\,[1-(.50)^6]\,[1-(.30)^6]\,[1-(.10)^6]\,[1-(.05)^6]$$

Similarly we have:

$$P_5 = (.95)^6\,[1-(.85)^6]\,[1-(.75)^6] - \text{etc.}$$
$$P_6 = (.85)^6\,[1-(.75)^6]\,[1-(.50)^6] - \text{etc.}$$

On the basis of the above table we have:

P_4 =	(.886) (.265) (.623) (.822) (.984) (.999)	= 0.118
P_5 =	(.735) (1623) (.822) (.984) (.999)	= 0.370
P_6 =	(.377) (.822) (.984) (.999)	= 0.305
P_7 =	(.178) (.984) (.999)	= 0.175
P_8 =	(.016) (.999)	= 0.016
P_9 =	(.001)	= 0.001
P_{12}=		= 0.000
		0.985

As a check on this calculation we have:

$$P_0 = (.114)\ (.265)\ (.623)\ (.822)\ (.984)\ (.999) = \frac{0.015}{1.000}$$

P_0 being the probability that no one of these basal ages will be attained.

If the average percentages for the six tests of each different age level for children of a given age be respectively p_4, p_5, p_6, p_7, etc., our calculations become:

$P_4 = p_4^6\ (1-p_5^6)\ (1-p_6^6) \ldots . (1-p_k^6)$

$P_5 = p_5^6\ (1-p_6^6)\ (1-p_7^6) \ldots . . (1-p_k^6)$ etc., and we have:

$$P_n = p_n^6\ (1-p_{n+1}^6)\ (1-p_{n+2}^6).(1-p_{k+1}^6)\ (1-p_k^6) \quad (A)$$

If we wish to be more exact we may observe the frequency with which children of a given age pass each test and take the product of the six values for any age level and substitute this product for p^6. This will not materially change the distribution unless the mean variation is large and the argument remains the same. Suppose these products be represented by $q_4, q_5, q_6, \ldots q_k$ and we then have

$$P_n = q_n\ (1-q_{n+1})\ (1-q_{n+2}) \ldots (1-q_{k-1})\ (1-q_k) \quad (B).$$

Having determined the distribution of basal ages we may proceed to the calculation of the probabilities that tests above this basal age will be passed.

If the frequency with which each of these tests are passed is known we may calculate the probability that a certain mental age will be attained.

Assuming, for purposes of illustration, that these frequencies are the same for seven year old children for all six tests of any age level, our calculation proceeds as follows. The probability that all six of the tests will be passed may be ignored since in that case the child would be included among those whose basal age is of this or of a subsequent year. We are therefore concerned with the probability that exactly five, four, three, two, one, or none of this group will be passed.

Suppose each of the tests of any age group be passed with a frequency p, the probability

that exactly 5 will be passed $= 6p^5\ (1-p)$,

" " 4 " " " $= 15p^4\ (1-p)^2$,

" " 3 " " " $= 20p^3(1-p)^3$,

" " 2 " " " $= 15p^2\ (1-p)^4$, (C)

" " 1 " " " $= 6p\ (1-p)^5$, and

" " 0 " " " $= (1-p)^6$

As a check on these calculations we may add p^6, the probability that all six will be passed, to the sum of these probabilities and our result should be equal to unity. Suppose, for example, that 75 percent. of seven year old children pass each of the seven year tests and we have the probability

that	exactly	5	tests	will	be	passed	= 0.356
"	"	4	"	"	"	"	= 0.297
"	"	3	"	"	"	"	= 0.132
"	"	2	"	"	"	"	= 0.033
"	"	1	"	"	"	"	= 0.004
"	"	0	"	"	"	"	= 0.000
							0.822
"	"	6	"	"	"	"	= 0.178
							1.000

If the probabilities for all six tests are not the same, it will not seriously change our results to use the mean probability for the six. Or to be more exact, if these probabilities be p_1, p_2, p_3, p_4, p_5, and p_6 we have the probability that exactly five tests will be passed equal to $p_1 p_2 p_3 p_4 p_5 (1-p_6) + p_1 p_2 p_3 p_4 p_6 (1-p_5) + p_1 p_2 p_3 p_5 p_6 (1-p_4) + p_1 p_2 p_4 p_5 p_6 (1-p_3) + p_1 p_3 p_4 p_5 p_6 (1-p_2) + p_2 p_3 p_4 p_5 p_6 (1-p_1)$. (D) Similarly the probability that exactly four tests will be passed is equal to:

$$p_1p_2p_3p_4\,(1-p_5)\,(1-p_6) + p_1p_2p_3p_5\,(1-p_4)\,(1-p_6) + p_1p_2p_3p_6\,(1-p_4)\,(1-p_5) +$$
$$p_1p_2p_4p_5\,(1-p_3)\,(1-p_6) + p_1p_2p_4p_6\,(1-p_3)\,(1-p_5) + p_1p_2p_5p_6\,(1-p_3)\,(1-p_4) +$$
$$p_1p_3p_4p_5\,(1-p_2)\,(1-p_6) + p_1p_3p_4p_6\,(1-p_2)\,(1-p_5) + p_1p_3p_5p_6\,(1-p_2)\,(1-p_4) +$$
$$p_1p_4p_5p_6\,(1-p_2)\,(1-p_3) + p_2p_3p_4p_5\,(1-p_1)\,(1-p_6) + p_2p_3p_4p_6\,(1-p_1)\,(1-p_5) +$$
$$p_2p_3p_5p_6\,(1-p_1)\,(1-p_4) + p_2p_4p_5p_6\,(1-p_1)\,(1-p_3) + p_3p_4p_5p_6\,(1-p_1)\,(1-p_2) \quad (E)$$

And we have similar series for three, two, one, and no tests, respectively.

Suppose that $p_1 = .7$, $p_2 = .7$, $p_3 = .75$, $p_4 = .75$, $p_5 = .8$ and $p_6 = .8$ then the probability

that	exactly	5	tests	will	be	passed	= 0.357
"	"	4	"	"	"	"	= 0.298
"	"	3	"	"	"	"	= 0.132
"	"	2	"	"	"	"	= 0.032
"	"	1	"	"	"	"	= 0.004
"	"	0	"	"	"	"	= 0.000
							0.823
$p_1p_2p_3p_4p_5p_6$ (the probability that all six will be passed)							= 0.176
							0.999

It is apparent that these results do not differ materially from those derived from assuming these probabilities all equal to the average, *i. e.* 0.75, as above.

If, therefore, one is to determine the expectations of mental age scores for the seven year children of each basal age group, he must calculate the probabilities that a certain total number of tests beyond the basal year will be passed. To do so, he will calculate as above the probabilities that 5, 4, 3, etc., tests respectively will be passed from each age group. He will tabulate these results and proceed to calculate the probabilities that a certain number will be passed from all groups above the basal age, beginning at the highest.

If the probabilities that 5, 4, 3, etc., tests are passed from the ten year group be respectively q_5, q_4, q_3, etc., and from the nine year group be r_5, r_4, r_3, etc., and the probabilities that 10, 9, 8, etc., respectively be passed from the two groups be x_{10}, x_9, x_8 etc., we have:

$$x_{10} = q_5 r_5$$
$$x_9 = q_5 r_4 + q_4 r_5$$
$$x_8 = q_5 r_3 + q_4 r_4 + q_3 r_5, \text{ etc., and}$$
$$x_1 = q_1 r_0 + q_0 r_1$$
$$x_0 = q_0 r_0$$

As a check on these calculations, we have Σ_q Σ_r etc., $= \Sigma_x$ where Σ_q is the sum of $q_5 + q_4 + \ldots q_0$, etc. In a similar way we may calculate the probabilities that 15, 14, 13, etc., tests respectively will be passed from the three year groups 8, 9, and 10. If these probabilities be y_{15}, y_{14}, y_{13}, etc., and those for the 8 year group be s_5, s_4, s_3, etc., we have:

$$y_{15} = x_{10} s_5$$
$$y_{14} = x_9 s_5 + x_{10} s_4$$
$$y_{13} = x_8 s_5 + x_9 s_4 + x_{10} s_3, \text{ etc.,}$$
and
$$y_1 = x_0 s_1 + x_1 s_0$$
$$y_0 = x_0 s_0$$

Again we have as a check:

$$\Sigma_x \Sigma_s = \Sigma_y$$

On the basis of the distribution of basal ages derived in our first table, we may proceed to determine the relative distribution of each group according to mental age. Since none attains a basal age of 10, we may assume that those represented by P_0, *i. e.*,

those not attaining the basal ages given, have a basal age of three years. If we distribute each basal age group according to the relative expectation of passing additional tests we get the following result:

Distribution of 7 year children according to mental-age score (Stanford Revision)

Mental age score		Basal ages							
yrs.	mo.	3	4	5	6	7	8	9	Total
9	0							.001	.001
	10						.001		.001
	8					.001	.002		.003
	6				.001	.005	.004		.010
	4			.001	.005	.013	.005		.024
	2			.004	.013	.025	.003		.045
8	0		.001	.012	.028	.036	.001		.078
	10		.004	.027	.047	.038			.116
	8		.008	.047	.059	.030			.144
	6	.001	.014	.065	.059	.018			.157
	4	.002	.020	.070	.046	.007			.145
	2	.003	.022	.061	.028	.002			.116
7	0	.003	.020	.043	.013	.000			.079
	10	.003	.014	.024	.005				.046
	8	.002	.009	.011	.001				.023
	6	.001	.004	.004	.000				.009
	4	.000	.002	.001					.003
	2	.000	.000	.000					.000
6	0								
		.015	.118	.370	.305	.175	.016	.001	1.000

It will be observed that this computation is effected in the case of the basal age 7, for example, by multiplying each of the expectations for passing tests from the 8, 9, and 10 year levels (y_{15}, y_{14}, y_{13}, etc.) by P_7 divided by the sum of these expectations, *i. e.*, $P_7 \div \Sigma_y$. Thus $\frac{P_7}{\Sigma_y} y_5 = 0.038$, the expectation that 7 year children having a basal age of 7 will pass five tests from the higher age levels and therefore attain a mental-age score of 7 yrs., 10 mos. This gives a "normal" distribution of mental-age scores with a mode of seven years and six months. This would suggest that the assumed frequencies are too high but this does not affect the argument.

In the case of the Goddard revision the determination of the theoretical distribution of mental-age scores would be made in much the same way. Using a similar notation and argument we have formulae, analagous to (A) and (B) above, for the distribution of basal ages as follows:

$P_n = p^5_n\ (1—p^5_{n+1})\ (1—p^5_{n+2}) \ldots\ldots\ldots\ldots\ldots (1—p^5_k)$ or
$P_n = q_n\ (1—q_{n+1})\ (1—q_{n+2}) \ldots\ldots\ldots\ldots\ldots (1—q_k)$

Here the probability that five tests will be passed from any age level above the basal age is excluded and for the probability that exactly four tests will be passed from any age level we have (where the relative frequencies for passing each of the tests of this age level are all equal to p) $5p^4(1-p)$,
for exactly 3 tests $10p^3(1-p)^2$,
" " 2 " $10p^2(1-p)^3$,
" " 1 " $5p(1-p)^4$, and
" " 0 " $(1-p)^5$.
These are, of course, analagous to (C) above.

Where these probabilities for any age level are not equal (p_1, p_2, p_3, p_4, and p_5) we have the probability that exactly four tests will be passed equal to $p_1p_2p_3p_4(1-p_5) + p_1p_2p_3p_5(1-p_4) + p_1p_2p_4p_5(1-p_3) + p_1p_3p_4p_5(1-p_2) + p_2p_3p_4p_5(1-p_1)$, analagous to (D) above. Similarly the probability that exactly three tests will be passed is equal to $p_1p_2p_3(1-p_4)(1-p_5) + p_1p_2p_4(1-p_3)(1-p_5) + p_1p_3p_4(1-p_2)(1-p_5) + p_2p_3p_4(1-p_1)(1-p_5) + p_1p_2p_5(1-p_3)(1-p_4) + p_1p_3p_5(1-p_2)(1-p_4) + p_2p_3p_5(1-p_1)(1-p_4) + p_1p_4p_5(1-p_2)(1-p_3) + p_2p_4p_5(1-p_1)(1-p_3) + p_3p_4p_5(1-p_1)(1-p_2)$. This is analagous to (E) above and we have similar series for two, one, and no tests.

For illustration of this method with the Goddard revision I am indebted to Mr. E. A. Doll of the Vineland Laboratory for empirical frequencies of so-called unselected children on each of the tests of this revision. I have made use of the data for the seven year group (39 children with average chronological age 7.4 years), the ten year group (68 children with average chronological age 10.5 years) and the twelve year group (69 children with average chronological age 12.5 years).

A theoretical distribution of mental-age scores by this method based on the observed mean frequencies with which children of these groups passed the individual tests gives results which correspond closely with the actual results in the case of these children, as will be observed from the following comparative table:

Age Groups	Number of Cases	Mean Chronological Age	Mean Mental-Age Scores	
			Actual	Calculated
7	39	7.4	7.2	7.3
10	68	10.5	10.6	10.7
12	69	12.5	10.8	10.9

It has been customary in working upon any revision or modification of the Binet-Simon tests to rescore individual records or re-test children according to the revised or modified scale. It would appear that, where no new tests were introduced, as for example in Doll's Abbreviated Scale, it would be a fairly reliable method to test the new scale by distributing the mental-age scores theoretically on the basis of frequencies already observed. Where new tests were introduced, it would be only necessary to determine empirical frequencies for these tests and introduce them into a theoretical treatment along with the data previously obtained for the tests which were not new.

As an example of this treatment Doll's Abbreviated Scale (1) gives for the 39 children of the seven year group mentioned above a mean mental-age score of 7.0 and for the 68 children of the ten year group a mean mental-age score of 9.6. Doll's actual results on other children give 7.0 and 9.7 for these age groups.

In the case of the Stanford Revision this method must be somewhat modified where tests above the 10 year level are involved. The argument, however, remains the same. In calculating the distribution of basal ages one must use p^8 and $(1-p^8)$ in place of p^6 and $(1-p^6)$ for the 12 year level. In calculating the expectation of passing beyond the 10 year level for distributing the mental age scores a new complication arises. The tests are weighted differently since a different value in months is given to the tests of different age levels. For this reason it is convenient to reduce each to months. A boy passing 5 eighteen year tests and 4 sixteen year tests scores $(5\times6) + (4\times5)$ or 50 months. This reduction to months may be continued into the age levels below 12 or after deriving the expectation from the 12, 14, 16, and 18 year levels one may reduce them to the equivalent of two month tests. Thus for 80 and 81 one may substitute 40, and for 78 and 79, 39, since the final expectations and distributions derived are to be on a two months' basis. Of course p_{40} in this case would equal $p'_{80} + p'_{81}$, and $p_{39} = p'_{78} + p'_{79}$.

The method can also be easily adapted to the abbreviated Stanford Scale (tests marked by asterisk) by an appropriate weighting of the tests involved. The theoretical correlation between this and the complete scale can thus be easily determ-

ined on the basis of empirical frequencies without the necessity of rescoring individual results or of testing additional children.

The term "mental-age score" rather than "mental-age" has been used in this treatment because it is objective and concrete, a qualitative and quantitative measure of a child's reactions to a series of tests given and scored in a standardized manner. Confusion has arisen because the term mental-age has been used by many writers in two senses which are not easily distinguished by the reader. On the one hand it is held to signify a quantitative expression of the child's intellectual status or intelligence level in terms of the average child. To say in this sense that a seven year child has a mental-age of eight years is to say that the child's intellectual status is equivalent to that of an average eight year child and above that of the average child of his own age. On the other hand the term mental-age has been used to signify the score attained by the child in a series of Binet-Simon tests. Even if one grants the psychological advantage of the concept mental-age in the first of these meanings, which may well be challenged except for popular use, one is only justified in using these terms interchangeably by assuming a perfect correlation between this score as obtained in the case of any child and the measure of that complex more-or-less undefined something which we call his intelligence or intellectual status. It is much more in keeping with our present limited knowledge of intelligence not to make this assumption and, except for popular use, to avoid the use of the term mental-age. As Witmer has pointed out (11), these tests show a child's "performance level" and one should speak of his mental age score rather than his mental age. It is confusing to use the term mental age in any sense other than that of a score or performance level in making the statement that "normal five year children have a mental age of six years." (Approximately the average score by the Goddard revision). Yerkes has overcome this ambiguity by scoring the child's performance on his point scale. Terman's term "intelligence quotient" also will avoid confusion if one does not press too strongly the assumption that the average child's intelligence quotient should be 100, or the idea that intelligence alone has been tested.

In other words the result of the child's performance is a score. To judge of the child's intellectual status or intelligence it is

necessary to interpret this objective result. His high score may be due to good health, good training, good intelligence in one or more performances involving different mental abilities or functions or in a combination of all of these. A low score must also be interpreted rather than accepted without question as an infallible index of low intelligence. It may, for example, be due to the arrangement of the tests in the scale as when a twelve year old boy is tested by the Goddard revision without using tests beyond the 12 year level. The chances are against his obtaining an I. Q. of 100 as he has no tests offered him for raising his score above 12 years.

Otis has already pointed out (6 and 7) that the relative frequencies obtained by those who have administered Binet-Simon tests are objective data which may be treated mathematically. These methods, whether applied to the Goddard, Stanford, or similar revisions, or adapted to the Yerkes-Bridges scale, should be developed so that these data may be considered on their own merits and not on any *a priori* assumption of "the validity of the scale," the nature of mental deficiency, etc.

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THE MEASUREMENT OF INTELLIGENCE: SIX HUNDRED AND FIFTY-THREE CHILDREN EXAMINED BY THE BINET AND PORTEUS TESTS

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Since the publication of my tests in 1915[1] a considerable amount of work has been done with them, chiefly in the direction of making further comparisons of the results obtained by their use with those got by the use of the Binet-Simon scale. They have been applied to several groups of normal children as well as to feeble-minded. It is the object of this paper to report these results and to offer some observations that have arisen through the extension of their use.

Re-Adjustment of Scoring

When the tests were first arranged they were graded, somewhat loosely, for the ages from three to thirteen years. This grading was for convenience only. It was not claimed that the age allotted to the highest test which was passed represented exactly the child's mental age. All that the tests were intended to show was that, in certain capacities, notably in prudence, forethought, ability to sustain attention, in power to profit by experience as shown by improvement through the practice afforded in the tests themselves, the child had reached a certain stage of development. It did not follow that this level corresponded with that of the child's general intelligence, though, in the majority of cases (between sixty and seventy per cent.) it was shown that the development of these capacities did proceed *pari passu* with that of general intelligence.

When the tests are used as an aid to diagnosis, the fact that the child quickly improves with practice is important. Hence, when the subject of the tests was suspected to be mentally deficient, it did not matter greatly whether the child barely succeeded or passed the tests with comparative ease. Yet this

[1] Journal of Psycho-Asthenics, June, 1915.

scraping through the tests by taking the full number of trials allowed, whilst it argued the possession of the power to improve rapidly with practice, certainly showed that the child lacked mental alertness. In order that the child's capacities might be exhibited in the fairest light, the tests for the lower years had been made a little easy for the mental ages allotted to each. In order, however, to make it unlikely that morons should pass the highest tests, these latter were made relatively more difficult. Hence, when diagnosis as to mental deficiency was not called for—as in the case of normal children—some adjustment was necessary. This was in order to make a distinction between the mentally alert and the slower, duller child who succeeded in passing the tests, but with frequent errors.

This adjustment, then, consists in counting the number of tests which the child passes on the last trial allowed by the test conditions: (two trials are allowed in tests up to, and including the eleven-year test, three trials in the twelve, and in the thirteen-year tests). If two tests are passed on the last trial, one year is deducted; if three tests, one year and a half; if four tests, two years are deducted from the age allotted to the highest test the child passes. The remainder is the mental age. Should a child fail outright in a test but succeed in a higher one, a year is deducted. Thus, for instance, a child passes in the 9-year test (two trials), fails in the 10-year test (two trials), passes in the 11-year test (one trial), succeeds in the 12-year test (three trials), and finally fails in the 13-year test. Twelve is the highest test passed. A year is deducted for the failure in the 10-year test, and another year for the two tests (nine and twelve) in which the child passed on the last trial. The mental age is twelve minus two years.

This adjustment evidently increases the difficulty of the series by making the scoring conditions harder. It also has the effect of minimizing some inequalities in the steps of the series. For instance, if a child fails in the 10-year test but succeeds in the 11-year, the deduction of a year is equivalent to transposing the positions of the two tests in the series.

Though individual tests, such as those for 10 years and 12 years, are somewhat difficult, it has not been considered advisable to alter them until sufficient data have been collected to make a final revision possible. In the meantime, the foregoing

adjustment makes the series more serviceable. By altering the scoring rather than the tests themselves, results previously obtained are still available for comparison.

Careful observation by the examiner during the application of the test is very necessary. Many interesting individual differences in the methods of attacking the problems may then be noticed. The child of impulsive and headstrong temperament does not attempt any preliminary survey of the design, but attempts to rush through the maze, usually falling into the first trap that presents itself. Nor does the failure deter it from making similar errors. Such a child will very often see its error immediately it is committed, but it seems quite impossible for it to pass a wrong turning without committing itself to the wrong course. The repetition of this kind of action seems almost to savor of obstinacy. The inference is that such children habitually proceed to action and consider the effect afterwards. They leap before they look.

Another child betrays irresolution and indecision of character by its action. It seems to have great difficulty in deciding which course to take. It studies the test too much. The possible mistakes obtrude themselves upon consciousness to such a degree that it cannot hold the clear course in view, so that it ends by confusing itself and falls into the very error it is so anxious to avoid. To such children the 11-year test seems to offer peculiar difficulty, whereas others find it particularly easy.

Over-confidence causes some to fall into error. The over-confident child may be distinguished from the child who is habitually impulsive and impetuous. The former learns prudence by its first error, the latter does not. It will be observed that allowance is made for over-confidence, as the first mistake is not penalized. The most intelligent attitude towards the test is that which is characterized by foresight in a preliminary planning of the course, together with a prudent following out of the plan. In some, impetuosity of action nullifies the good effect of preliminary study. Such children appear to trust too much to memorizing the whole course to be pursued, instead of using careful observation whilst at work.

The most common source of error is heedlessness, carelessness, inability to allow thought to precede action. A child who possesses this fault may quite possibly appear brilliant as regards

educational attainment. School examinations and tests of attainment such as the Binet show these children in a too favorable light. We are prone to over-rate the glib-tongued, quick-witted person who may possess, at the same time, an infirmity of temperament so grave as to render success in after life unlikely. Irresolution, impetuosity, heedlessness, lack of staying power, count for comparatively little in the childish period. It is only when later life brings real problems to the individual, that these faults of disposition, previously overlooked, become apparent. Hence it is that fortunate prognostications as to the success of some of our brilliant pupils are unfulfilled.

Performance of the Feeble-minded

In the case of the feeble-minded, school progress weighs too heavily with us when we attempt diagnosis. There is one well-marked type of child in whom educational aptitudes are at least moderate, but there is such a feebleness of will energy, such a morbid self-consciousness and fearfulness of failure, that he is quite unfitted to compete with his fellows, but remains in a state of dependency throughout life. Surely, in the evaluation of intelligence, such traits of character are at least equal in importance to reading, spelling, and computing skill. In childhood such cases are well designated "potentially feeble-minded." Hence the importance of tests that enable us to prove the possession of the positive virtues of care and prudence, deliberative action and forethought.

Somewhat contrary to my first expectation, the feeble-minded, as compared with normals, do not show any specific differences in their methods of attacking the tests. That is to say, the young normal child makes the same mistakes and in the same manner as do the mentally deficient who are older. Some undoubtedly feeble-minded children exhibit care and prudence, though the majority are impulsive and unable to profit by experience. But, as before mentioned, it is this very heedlessness—though shown in a lesser degree—which is the most fruitful source of failure with children of ordinary development. There is, then, no particular incapacity which may be considered peculiar to the feeble-minded. The correlation between the results obtained from the use of the Binet and of my own tests for a group of 200 mentally deficient is very little higher than that

for a corresponding group of normal school children. The view previously taken, that the tests are peculiarly adapted for the mentally deficient holds good only from the standpoint that the proof of the possession of the capacities tested by my series is so important both in diagnosis and prognosis. The exhibiting of the feeble-minded child's one talent is relatively more important than its display in a normal child who possesses also the other nine. Apart from this consideration, the theory that incapacity for prudence, foresight, etc., is one of degree and not of kind is important from the standpoint of the psychology of feeble-mindedness. If substantiated, it would tend to prove that "feeble-minded" is not a generic term, but that the mental defective is simply a very dull normal. If there is no dividing line between mental deficiency and mere mental dullness, the search for absolutely diagnostic tests is vain. Definition must proceed through social reference to the "ability to manage oneself and one's affairs with ordinary prudence." Like the insane, the feeble-minded will be defined by what he does. Hence the importance of tests of performance, provided they give any reliable indication of habitual behavior and disposition. In this connection, the application of my own and similar tests to social delinquents should give interesting results.

Comparison of Binet and Porteus Tests

For purposes of comparison, the Binet and my own tests were applied to three groups of children. The first consisted of two hundred feeble-minded children. A summary of the variations between the results of the two tests is shown in Table 1. The individual records are interesting but would occupy too much space to offer in detail. Table 2 gives a similar summary for a group of 190 normal children, taken in a chance distribution through the lower and middle grades of a city school. For both the above-mentioned groups Goddard's revision of the Binet scale was used. This revision was found to be eminently serviceable, except for the upper years. The test as arranged for 10 years appeared too difficult for Australian children of that age. If only the common coins were used in the recognition test, the question was too easy, since nearly all 9-year children knew them. If the more uncommon gold coins—uncommon, that is, from the child's experience—were used,

very few children of 10 years knew them. The two memory tests in this year are difficult, whilst several of the questions in the comprehension-of-difficult-questions test (X 4) are needlessly incomprehensible. Again, in the 12-year test, the "memory for sentences" test is certainly too hard, whilst failure in the "resistance to suggestion" test does not, I believe, signify much regarding intelligence.

Considering these imperfections in the scale, one had reason to doubt the reliability of estimates of mental age for children of the higher ages. In order to collect data for comparison for the ages 11 to 14, Terman's revision was used with a third group of children, of whom about 80 belonged to the upper grades. I am inclined to the belief that the Terman revision is more correct on the whole. Certainly, the higher age tests appear more reliable. At the time of the investigation the last-named revision had not been published, but was made available for use through the courtesy of Dr. Terman. Though the position of certain tests in the lower years is surprising, their difficulty is lessened by making the scoring conditions easier; as, for example, in certain rote memory tests, where one out of three trials suffices for a pass. The summary for this third group is given in Table 3.

Table 4 shows the results for all cases, 653 in number. The great majority of the children were tested by the writer personally, and all under his immediate supervision.

SUMMARY OF VARIATIONS

BINET AND PORTEUS TESTS

TABLE 1

Two Hundred Mentally Deficient

Variation	Number of Cases	(Goddard's Revision) Percentage
No difference	45	22.5
Half Year	48	24
One Year	61=154	30.5=77
1½ Years	18	9
2 Years	14=32	7 =16
2½ Years	7 14	3½
3 Years	6	3
3½ Years	1=14	½= 7
Total Cases	200	

Correlation: r=.7 P.e=.024.

TABLE 2

One Hundred and Ninety Normal Children

Variation	Number of Cases	(Goddard's Revision) Percentage
Half Year	45	23.6
One Year	46=137	24.2=72
1½ Years	22	11.6
2 Years	13=35	6.8=18.4
2½ Years	7	3.7
3 Years	5	2.6
3½ Years	5	2.6
4 Years	1=18	.5=9.5
Total Cases	190	

Correlation: r=.69

As will be seen by comparing Tables 1 and 2, in both groups over 70% showed variations of a year or less, whilst over 90% showed a deviation of two years or less.

The results by the two series of tests were in slightly closer agreement with the feeble-minded group than with the normal.

TABLE 3

Two Hundred and Sixty-three Cases (Terman's Revision)

Variation	Number of Cases	Percentage
No difference	49	
Half Year	82	
One Year	60=191	72.6
1½ Years	44	
2 Years	15=59	22.4
2½ Years	11	
3 Years	1	
3½ Years	1=13	5

Correlation: r=.77

TABLE 4

Six Hundred and Fifty-three Cases (All Tables)

Variation	Number of Cases	Percentage
No difference	140	
Half Year	175	
One Year	167=482	73.8
1½ Years	84	
2 Years	42=126	19.2
2½ Years	25	
3 Years	12	
3½ Years	7	
4 Years	1=45	7

In Tables 1 and 2, in reckoning the Binet age one-fifth of a year has been disregarded, two-fifths and three-fifths reckoned as half a year and four-fifths as a whole year. In this I have followed Mr. Cunningham's suggestion. For the Terman revision (Table III) up to three months has been disregarded, from four to nine months reckoned a half-year, and ten and eleven months an additional year.

From examination of the tables it will be seen that the relation between the two series is fairly constant. We may safely make the generalization that in any large group of unselected children about 70 per cent. of the total number will test by my series within one year of their mental age according to Binet. In the present investigation this has held good for each hundred tested. This fact is important, as it has a bearing on the summary dealing with sex-differences.

Assuming the general reliability of the Binet this agreement justifies the contention that, in the remaining 30 per cent. of cases, the verdict of the Porteus tests is worth considering when we are attempting the evaluation of intelligence.

Sex Differences

The following summary is based on the performances of boys and girls in the normal groups only. It gives a somewhat remarkable view of the sex differences. If the number (453) tested is sufficient to found such an important generalization upon, it shows that the performance of the girls differs distinctly from that of the boys. In the case of the former there is a closer agreement between the estimates of intelligence by the two series. Seventy-nine per cent. of the girls test within one year of their mental age according to Binet as against 67 per cent. of the boys. The limits of variability in the case of the girls are narrower; no girl tests more than 2½ years above or below her mental age. Thirteen boys show a greater variation than 2½ years.

That the girls generally speaking test lower than the boys is shown by the fact that 40 per cent. test below their Binet age, 33 per cent. above. Of the total number of boys, approximately 30 per cent. test below their Binet age, 53 per cent. above.

The conclusion that these figures appear to warrant is that in the capacities tested by my series girls do not show, on the

whole, a development equal to that of the boys. Their results tend to group closer around the Binet ages, with at least as many below as above. Boys tend to test higher, with a greater mean variation.

The number of girls (200) that was tested is certainly not so great as the number of boys (253). Yet the group results shown in the previous tables justify the expectation that a larger number would give similar results. If further investigations confirm the conclusion, an interesting sex difference will have been displayed. A possible explanation is that the puzzle element in the tests appeals more to the boys' interest than to the girls', although lack of interest is rarely apparent in either boys or girls. Probably the impulsive temperament is more often found in females. Foresight and the ability to plan are usually considered masculine attributes. It would be very interesting indeed if experimental evidence were afforded that, even in childhood, behavior reflects these sex distinctions. The figures are appended.

TABLE 5

Sex and Performance

Variation	Number of Cases	Boys	Percentage	Number of Cases	Girls	Percentage
No difference...	41			53		
Half-Year.....	70			58		
One Year.....	59			47		
	—			—		
		170	67.1		158	79
1½ Years.....	40			26		
2 Years.....	19			9		
	—			—		
		59	23.3		35	17.5
2½ Years.....	11			7		
3 Years.....	6			0		
3½ Years.....	6			0		
4 Years.....	1			0		
	—			—		
		24	9.5		7	3.5
Total Cases.. (Boys)	253		Total Cases.. (Girls)	200		

	Boys	Girls
Number Testing Above their Binet Age.....	134 (53%)	66 (33%)
Number Testing Below their Binet Age.....	78 (30%)	81 (40%)

TABLE 6

Relation to Chronological Age

1. Number who tested *above* their actual age by both series (advanced)	178
2. Number who tested *below* their actual age by both series (retarded)	129
Total	316
3. Number who tested above age by one series and below by the other	137
Grand Total	453

Results of Re-Examinations

Table 7 gives the results of another investigation showing the effects of re-examining children after a year's interval. In 1915 Mr. K. S. Cunningham examined 100 normal children by both series.[2] In 1916 Miss Rolls re-examined 47 of these children, with a view to determining whether my test could be re-applied with advantage. Results would have been more reliable if the same observer had carried out both investigations. As each, however, had worked under my immediate supervision the reliability co-efficient was probably high.

By reference to columns V and VIII of the table the year's gains or losses for each child in each series can be compared. Some children evidently profited by their previous experience in my tests, and improved their positions by from two to four years. The first 20 cases listed in the table made, however, less than a year's progress. That the improvement of the others was not wholly due to previous experience is shown by averaging the Binet gains. The first 20 gained among them 9½ years and lost 1½ years. The average net gain for these children may be reckoned as two-fifths of a year. The remaining 27 children gained a little over one year according to the Binet and two years according to my series. Some of the gains in my tests were in the direction of making up a deficiency as compared with the Binet, and in 11 cases brought the two estimates of mental age closer for 1916 than they were in 1915.

A very significant fact is that, in the case of the Binet, 10 children only out of the whole number gained one year in mental age during the 12 months, whilst nine children made a similar gain by my tests. Nine children by the Binet, and 12 by my tests, did not gain at all. This goes to show that mental development, chronologically considered, is by no means regular.

[2] K. S. Cunningham. *Binet and Porteus Tests Compared. Examination of One Hundred School Children.* Journal of Educational Psychology, 7: 1916, 552–556.

TABLE 7

Re-examination After a Year's Interval

Case No.	Age 1915	Binet 1915	Binet 1916	Binet Gain or loss	Porteus 1915	Porteus 1916	Porteus Gain or loss	Variations between tests 1915	Variations between tests 1916
1	8	10	10½	+ ½	11	10	—1	1	½
2	8½	10½	11	+ ½	12	11	—1	1½	0
3	7½	9	9	0	10	9	—1	1	0
4	6½	7	6½	— ½	7	6	—1	0	½
5	8	7	8	+1	10½	10	— ½	3½	2
6	6½	8½	10	+1½	7	7	0	1½	3
7	9	10	10	0	13	10	0	3	3
8	9	10	10½	+ ½	12	12	0	2	1½
9	10	10½	10½	0	8	8	0	2½	2½
10	5½	7	7	0	7	7	0	0	0
11	7	9	10½	+1½	10	10	0	1	½
12	8	9	10	+1	9	9	0	0	1
13	6	8	8½	+ ½	10	10	0	2	1½
14	9½	11	11½	+ ½	11	11	0	0	½
15	9½	10½	11	+ ½	11	11	0	½	0
16	12	10	10	0	10	10	0	0	0
17	6	7	6½	— ½	7	7	0	0	½
18	5	6	7	+1	6	6½	+ ½	0	½
19	6½	9	9½	+ ½	8½	9	+ ½	½	½
20	11	11	10½	— ½	10½	11	+ ½	½	½
21	11	9	11	+2	9	10	+1	2	1
22	10	8	9	+1	8	9	+1	0	0
23	6	7	7½	+ ½	5	6	+1	2	1½
24	5½	6½	7½	+1	7	8	+1	½	½
25	9½	11	11	0	12	13	+1	1	2
26	6	9½	9½	0	9	10	+1	½	½
27	7	6½	8	+1½	7	8	+1	½	0
28	6½	7½	8	+ ½	8	9	+1	½	+1
29	5½	7	7	0	6	7	+1	1	0
30	7½	9½	10½	+1	9	11	+2	½	+ ½
31	8½	9½	11	+1½	10	12	+2	½	+1
32	9	7½	7½	0	7	9	+2	½	1½
33	6½	8½	10	+1½	7	9	+2	1½	1
34	9½	9	11	+2	9	11	+2	0	0
35	9	7	8½	+1½	8	10	+2	1	1½
36	5½	6½	7½	+1	5	7	+2	1½	½
37	6½	6½	9	+2½	7	9	+2	½	0
38	7	9	10	+1	8	10	+2	1	0
39	9	8	9½	+1½	8	10½	+2½	0	1
40	7½	10½	11	+ ½	8	11	+3	—1½	0
41	7	9	9½	+ ½	8	11	+3	1	+1½
42	7½	6	7½	+1½	6	9	+3	0	1½
43	6½	9	10	+1	8	11	+3	—1	+1
44	7	8	10	+2	6	9	+3	—2	—1
45	7½	7½	8	+ ½	6	9	+3	—1½	+1
46	5	6½	8	+1½	6½	10	+3½	0	2
47	7½	9	10	+1	7½	11½	+4	—1½	+1½

The number tested is, of course, too small to found generalizations upon, but the table is certainly somewhat interesting. It is to be regretted that a greater number of Mr. Cunningham's cases were not available for re-examination. The results of this investigation are, however, sufficient to prove that my test can be re-applied with advantage, provided that a long enough interval of time is allowed to elapse between the two examinations.

Age Distribution

In the accompanying graph the actual distribution according to their mental ages of all children is shown, the Binet ages by a black line, the Porteus by a dotted one. Half-years have been disregarded, and one curve has been superimposed upon the other. As will be seen the curve for the Porteus series has a distinct "skew" for the 13-year numbers. This may be at least partially explained by the fact that this age marks the upper limit of the scale, and that some children would undoubtedly have gone beyond this limit had there been higher tests. Otherwise the distribution curve may be regarded as fairly regular. It is somewhat steeper in outline than that for the Binet ages. The actual age distribution is shown beneath. It will be seen that there was, actually, an excess of 13-year-old children.

Where Errors Occur

The maze designs that are appended are to show an analysis of the errors that were made by one hundred seventh and eighth grade children. The numerals show the number of errors that were made at each wrong turning or opening.

The large number of errors shown in the ten-year test is partially accounted for by the fact that this was the first test given throughout this investigation. Consequently, some children made mistakes through under-estimating its difficulty or through lack of practice afforded by the usual course of working through the lower tests. The proper procedure is to start with the easier tests. It is not advisable to start any children with a test higher than that for eight years.

By following the plan of marking where errors are made, data as to the relative difficulty of the individual tests can be obtained. These data could then be used in any attempt at

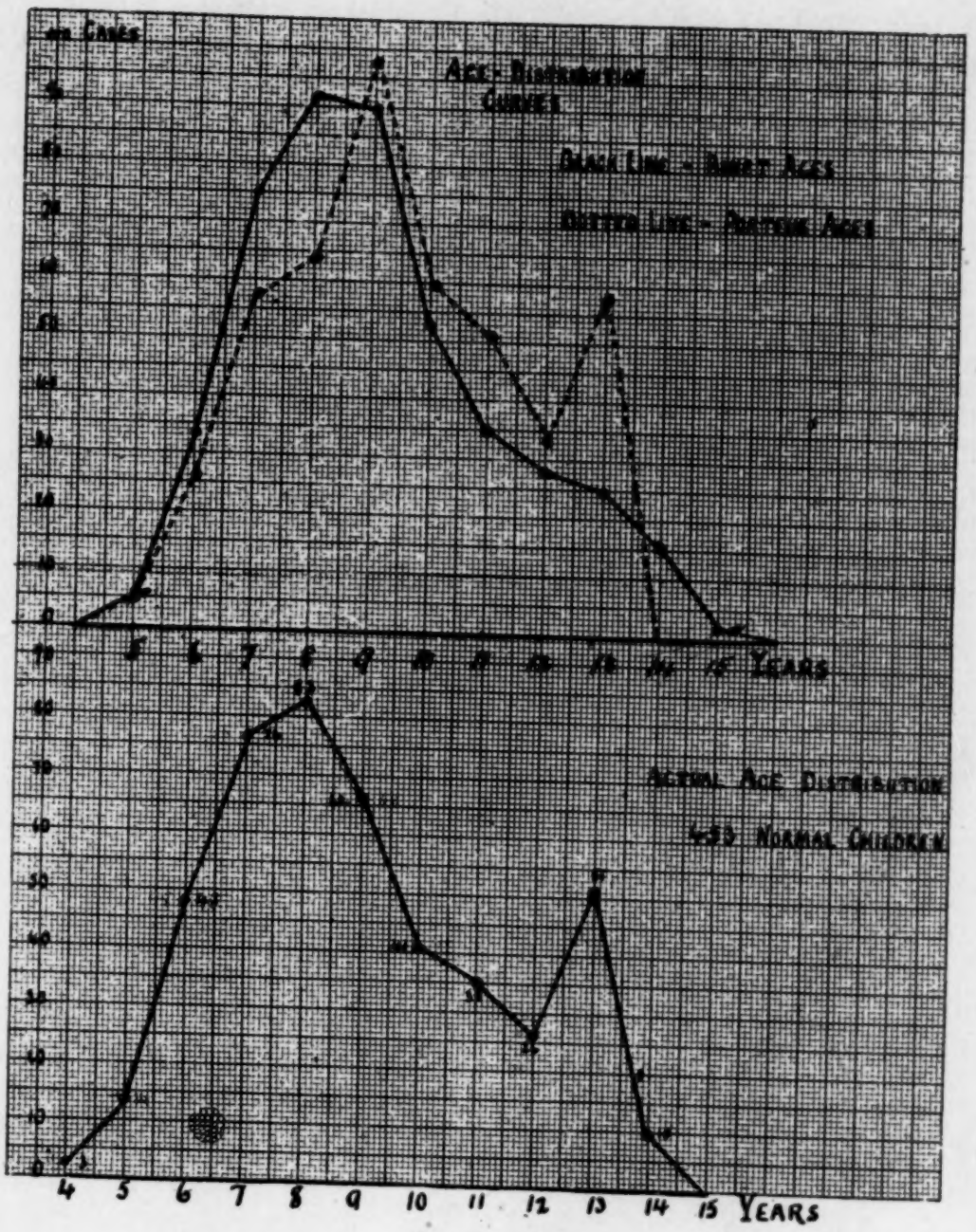

Age-Discrimination Curves
Black Line - Binet Ages
Dotted Line - Porteus Ages
Actual Age Distribution
439 Normal Children
Years
4 5 6 7 8 9 10 11 12 13 14 15

FIGURE 1

TABLE 8

Test with Delinquents

(Cunningham & Porteus, 1915)

Case No.	Age	Porteus Test	Deficiency	Personal Records
1	13.3	10 years	—3	Truancy and incorrigible.
2	12	10 "	—1	Orphan, committed as neglected child.
3	15.9	11 "	—2	Committed as a neglected child.
4	12.3	10 "	—2	Truant and incorrigible.
5	14	10 "	—3	Neglected child.
6	16.5	11 "	—2	Illegitimate. Committed to Home.
7	12.7	12 "	— ½	Neglected child.
8	12.7	9 "	—3½	Committed to Home as neglected child.
9	13.10	10 "	—3	Neglected.
10	11.9	12 "	0	Neglected.
11	11	12 "	—1	Father died, mother unable to support.
12	11	10 "	—1	Neglected.
13	13½	12 "	—1	Neglected.
14	13½	9 "	—4	Truant, petty thief.
15	11½	9 "	—2½	Truant, thief.
16	12½	8 "	—4½	Illegitimate. Petty thieving.
17	11	9 "	—2	Neglected.
18	12.3	10 "	—2	Neglected.
19	14.2	11 "	—2	Bad companions. Petty thief.
20	12.3	11 "	—1	Truant.
21	11.10	11 "	—1	Truant.
22	11.7	9 "	—2½	Petty thief.
23	14	8 "	—5	Larceny. Absconded twice from Reformatory.
24	16	11 "	—2	Housebreaking, absconded 3 times.
25	13	10 "	—3	Shop-breaking. General bad character.
26	16.3	12 "	—1	Larceny, stealing from shops.
27	15.6	11 "	—2	Unlawful assault.
28	17.4	11 "	—2	Housebreaking.
29	17	9 "	—4	Vagrant.
30	16	10 "	—3	Vagrant.
31	16	7 "	—6	Vagrant.
32	16	12 "	—1	Vagrant.
33	15	9 "	—4	Serious assault. Obscene language.
34	14.4	12 "	—1	Vagrant.
35	16.10	11 "	—2	Thief. Incorrigible. Stealing from houses.
36	17	9 "	—4	Vagrant.
37	15.6	9½ "	—3½	Vagrant and thief. Absconded 5 times.
38	16	8 "	—5	Larceny. Serious assault. Bad character.
39	14.6	8 "	—5	Burglary. (In company with cases 24 and 28.)
40	15	8 "	—5	Vagrant. Stealing letters. (Specific disease.)
41	15	9 "	—4	Murdered companion.
42	14.8	8 "	—5	Vagrant.

TABLE 8—*Continued*

Tests with Delinquents (Girls)

Case No.	Age	Porteus Test	Deficiency	Dr. G. Halley Personal Records and Remarks
43	16	7½	5½ years	Immoral.
44	14	8	5 "	Unemployable. Vagrant. Mental Defective.
45	19	10	3 "	Violent temper. Uncontrollable at home.
46	18	10	3 "	Immoral.
47	18	7½	5½ "	Illiterate. Immoral.
48	18½	6½	6½ "	Immoral. Unemployable.
49	18	5	8 "	Illiterate. Immoral. Unemployable.
50	15	10	3 "	Neglected. Committed to Home.
51	17½	10	3 "	Immoral. Vagrant.
52	16	5	8 "	Mental defective. Unemployable.
53	19	5	8 "	Mental defective. Neglected.
54	16	10	3 "	Vagrant. Runs away.
55	17	12	1 "	Fair mentally. Neglected.
56	18½	13	0 "	Good worker. Family history bad.

revision. The effect of even small alterations either in the direction of lessening or of increasing the difficulty of the maze designs could thus be estimated.

Application of the Test to Delinquents

In order to show the applicability of the tests to juvenile delinquents a summary of results for 56 cases is given in Table 8. Unfortunately, the Binet results are not available for comparison. A brief entry regarding the personal history of each case follows the test records.

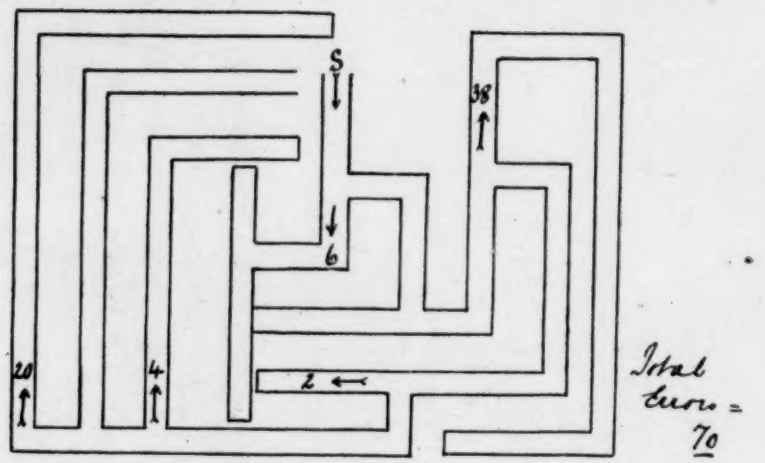
The expectation that the habits of impulsive and ill-considerate action characteristic of this class of children would be reflected in the test-results is amply fulfilled. It was very rare, indeed, to find an individual who succeeded in the 13-year test. The majority tested far below their chronological age, even though no definite diagnosis of mental deficiency had been made previously.

In this and the following investigation the numbers tested are small. The results are reported merely as indicating directions in which the tests might be usefully applied.

Cases 1–22 were from the Burwood Boys' Home, cases 23–42 from the Royal Park Reformatory, cases 43–56 from the Home for Girls, Burra, South Australia.

In Table 8 the fourth column gives the difference between the age by the test and 13 years—the highest test of the series. Considering the fact that the chronological ages are so much

Ten Year Test.

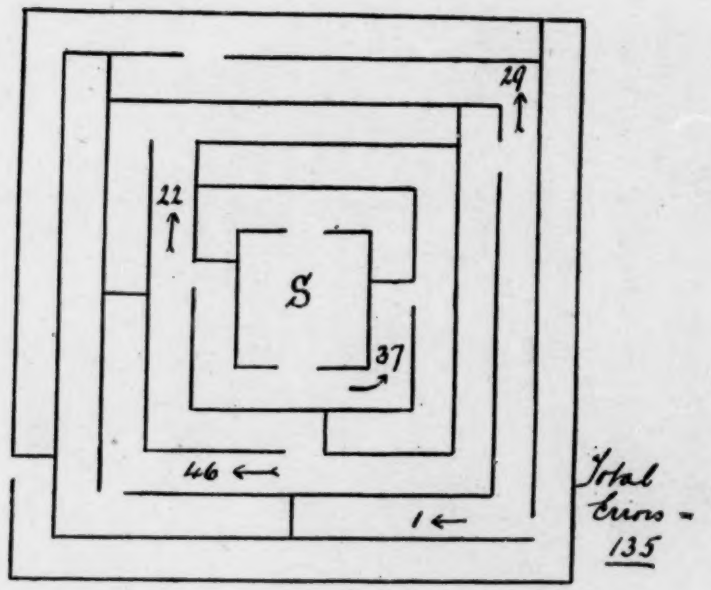


Where Errors Were Made
100 Cases.
VII and VIII Grades

S.—Starting Point.
⟶.—Direction in which to move.

FIGURE 2

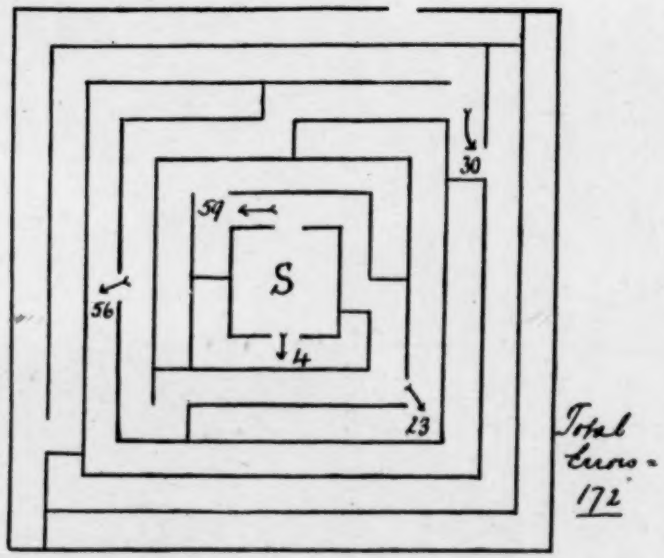
Twelve Year Test.



Where Errors Were Made.
100 Cases.
S.—Starting Point. VII & VIII Grades
⟶.—Direction in which to move.

FIGURE 3

Thirteen Year Test.



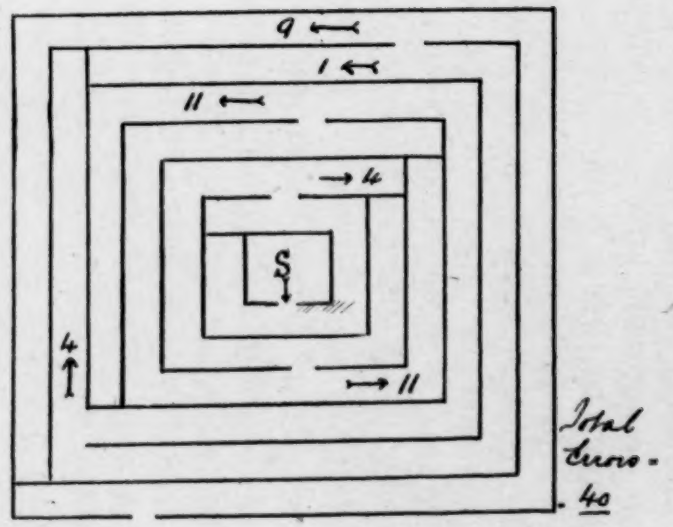
Where Errors Were Made.
100 Cases.
VII / VIII Grades

S.—Starting Point.

➤—Direction in which to move.

FIGURE 4

Eleven Year Test.



Where Errors Were Made.
100 Cases.
VII / VIII Grades

S.—Starting Point.

➤—Direction in which to move.

FIGURE 5

above the latter limit, the deficiency is really much greater than appears. All the cases listed have been committed by the Courts to the care of the Homes or to the Reformatory. Some were more neglected than delinquent, but in every case the child's character or association rendered commitment to the Home necessary. Group 1 represents criminals in the making, Group II (cases 23–42) the criminal already made. Group III (cases 43–56) is made up of cases who must for their own protection, be kept under restraint. These latter results are available through the courtesy of Dr. Gertrude Halley, Schools' Medical Officer, South Australia.

Deaf and Dumb Children

A small group of children was examined at the School for Deaf and Dumb, Melbourne.

In applying the test, the procedure adopted was to illustrate the task by a test at a much lower level than the child was expected to reach. When the child understood what was required, he began with the next higher test. In the case of the lower tests the procedure was illustrated by a test of similar design.

With the exception of certain children who were proved mentally deficient, both by the experience of the teachers and the verdict of the tests, these subjects did not differ markedly in their performance from other children. The slow and methodical disposition was not often seen. Perceptions were apparently acute, the errors being made chiefly through inpulsiveness rather than through irresolution. The puzzle element in the tests appealed to them greatly. A small group was tested merely to prove the applicability of the tests to these cases.

TABLE 9

Deaf and Dumb Children

Case No.	Age	Porteus Test	Difference	Case No.	Age	Porteus Test	Difference
1	15 years	13		13	12	13	+1
2	12 "	12	0	14	9	9	0
3	14 "	13		15	9*	6	−3
4	15 "	13		16	9*	5	−4
5	13 "	13		17	10	9	−1
6	11 "	10	−1	18	9	8	−1
7	11 "	11	0	19	9	10	+1
8	12 "	13	+1	20	14	12	−1
9	15 "	10	−3	21	15	12	−1
10	12 "	13	+1	22	15*	7	−6
11	13 "	12	−1	23	13*	9	−4
12	12 "	10½	−1½	24	12*	5	−7

* Mentally deficient.

Summary of Conclusions

1. The tests, with an adjustment of the scoring conditions, may be applied with advantage to normal children as well as to mentally deficient. The adjustment is made by taking into account the number of trials required by the child in passing the tests.

2. By careful observation on the examiner's part, facts regarding children's dispositions become apparent through the use of the tests. These facts are not revealed by the Binet examination and have an important bearing on the evaluation of intelligence. It is claimed that the tests form a necessary supplement to the Binet scale.

3. Failures in the tests are mainly due to impulsiveness, habitual carelessness, irresolution. These operate alike in the normal and in the mentally deficient, in the latter to a greater degree. Mental deficiency appears to be merely an extraordinary mental dullness, and it is the writer's opinion that no single test can be devised which will be absolutely diagnostic. Borderline cases must be decided by the application of a number of tests.

4. The relation between this series and the Binet tests is, for large groups of children, fairly constant: about 70 per cent. test within one year of their Binet age.

5. Girls' performances on the whole differ distinctly from that of the boys. The former's results tend to group themselves closer around the Binet ages with more below than above.

In the case of boys the position is reversed. Possible explanations of the differences are:

(*a*) Chance, due to an insufficient number tested, though there is fairly conclusive evidence against this theory.

(*b*) Actual sex differences, *e. g.*, greater tendency to impulsive behavior on the part of girls, over-anxiety, nervousness, lack of planning capacity.

6. The tests may be re-applied with advantage after one or two years interval. Development of the capacities tried out by the tests does not proceed evenly, chronologically speaking.

7. Interesting results may be obtained by the application of the tests to delinquents. Characteristic behavior is reflected in their working of the tests.

8. They may be applied also to deaf and dumb children, and by their aid an estimate of intelligence and educability may be obtained.

FRESHMAN TESTS AT THE STATE UNIVERSITY OF IOWA

IRVING KING AND JAMES M'CRORY

State University of Iowa

In the autumn of 1916 practically all the freshmen entering the College of Liberal Arts at the State University of Iowa were given a series of mental tests. There were 276 women and 268 men.

The tests selected were the following:

1. The Courtis Standard Arithmetic Test, Series B, covering problems in the four fundamentals. This test was given exactly as prescribed by Courtis. A single grade for speed was obtained by adding together all the "attempts." The total number of "rights" was divided by the number of "attempts" for the total percentage of accuracy.

2. A list of twenty-four "mixed relations" or analogies of a fairly difficult type (a set designed by Whipple).

3. Two tests of "opposites." The stimulus words were four hard lists used by Simpson and reported in his "Correlation of Mental Abilities" (1911). These words were rearranged into two lists of forty words each, in order from the easiest to the most difficult, according to the standard of difficulty determined by Gold and King, and published in the JOURNAL OF EDUCATIONAL PSYCHOLOGY, October, 1916.

4. The first three paragraphs of the Completion Test (Mutilated Prose) used by Simpson.

5. Visualization; the three inch cube test, each of the nine questions being weighted on the basis of previous experimentation and assigned a percentage value.

6. Range of Information; Whipple's one hundred technical words. The subjects marked the list to indicate first, which words they could define or explain, and secondly those words with which they were roughly familiar. They were then asked to write the definition or explanation of the first five words which they had indicated as being able to explain. On the basis of these definitions the grade for the entire test was com-

puted, one-fifth of the entire grade being deducted for each wrong definition.

7. Logical Memory, using the paragraph given in Whipple's Manual entitled "The Dutch Homestead." The paragraph was read to the subjects and they were then asked to write as much as they could recall. The papers were graded on the basis of the number of ideas they were able to reproduce according to the standard given in the above mentioned Manual.

All of these tests were given to the Freshmen in groups of from ten to twenty-five. They were timed with a stop watch in each test except in the last three as listed above. The grades for "Opposites," "Analogies," and "Completion" were computed by first marking the errors on each paper and then adding to the time score in seconds, 5 percent. of the time for each error. For instance if it took a student three minutes and twenty seconds to complete a test his score would be 200 which is the number of seconds. If he made on error it would add 5 percent. of that which would make his score 210.

Scoring of Results

In any investigation of this sort, where there are no standards established, it becomes necessary to set up arbitrary standards for grading. This was found to be the case with nearly every one of the tests given. There is a basis, however, for each method used.

Since each of the different tests had a system distinctly its own, there had to be a common basis so that the average of all the tests could be computed and so that the tests could be compared with each other. The following system was devised for such comparison. The median of each distribution of grades was found for each sex; the deviation of each individual from that median was next found; that deviation was multiplied by a factor obtained by dividing the median into 100. This method gave us the grades as multiples of 100. Zero was, of course, the middle case. The algebraic sum of these corrected deviations was then found and divided by the number of tests, which gave the average for all the mental tests. These averages were half above zero and half below, or in other words they were half positive and half negative.

Distribution of Medians and Ranges in the Various Tests

Test	Med. Girls	Med. Boys	% Boys Reaching Med. of Girls	Range Girls	Range Boys
Arith. Speed.....	50	52	60	19–97	23–97
Arith. Accuracy.....	74	77	55.4	16–100	24–100
Completion.....	335	378	36	770–159	841–154
Analogies.....	228	213	53	480–105	720–85
Opposites Easier.....	350	384	41	840–144	1128–171
Opposites Harder.....	900	823	64	1512–318	1538–263
Opposites Comb.....	1239	1215	54.1	2055–486	2658–551
Information.....	25	28	61.6	0–59	0–78
Logical Memory.....	43	36	32	21–78	9–65
Visual Imagery.....	33.5	42.5	68	0–100	0–100
Ages.....	19.62	19.61	50	16–30	17–25

In examining the third column of figures we observe that the boys slightly excel in several of the tests, the exceptions being the completion, easier opposites and logical memory. When the two opposites tests were combined, we find that more than 50 percent. of the boys reach or excel the median grade of the girls. In visual imagery test the boys excel the girls in the greatest degree. We note, however, that the median score made by the girls was only 33.5 out of a possible 100. In this test there were no girls who made a score of zero while there were eight who made a perfect score of 100. Using the median of the girls' scores as a basis and taking the gain of the median of the boys' score over this, we find that the boys accomplished 27 percent. more than the girls.

Variability

Test	Boys	Girls
Arithmetic—		
a. speed.....	.17	.22
b. accuracy.....	.17	.16
Completion.....	.20	.18
Opposites.....	.13	.18
Analogies.....	.18	.23
Logical Memory.....	.22	.17
Information.....	.25	.32
Visual Imagery.....	.41	.37

We see from these results that the statement that boys are more variable than girls is not borne out as far as these tests are concerned. If we should add the total variation we find that the boys have 173 and the girls 183 which would make the boys less variable if that one figure were to be taken as a measure. When we divide the tests we find the boys are more variable in four and the girls more variable in the other four.

The above coefficients of variability were computed by dividing the standard deviation by the median.

Discussion of Results

Arithmetic

The Courtis Arithmetic Test, Series B, which we used, has been given to more than a million school children. It is a test in the four fundamentals, and each of the four is usually graded separately. The writers pooled the four grades into a single index. The total number of attempts was taken as speed and the total number of right answers divided by the total number of attempts was taken as the index of accuracy.

Correlations

	Girls	Boys		Girls	Boys
Speed with Accuracy	41	38	Accuracy with Speed	41	38
Completion	22	25	Completion	16	13
Opposites	03	Neg.	Opposites	01	Neg.
Analogies	17	04	Analogies	22	18
Information	06	Neg.	Information	13	Neg.
Vis. Imagery	13	Neg.	Vis. Imagery	20	Neg.
Log. Memory	11	Neg.	Log. Memory	13	Neg.
Test Average	51	56	Test Average	48	41
Uni. Grades	31	36	Uni. Grades	40	36

The above coefficients are all Pearson "r's". They will be used throughout the article.

The writers believe this test should be omitted from any series of tests designed for use with university freshmen. In the first place it takes too much time. Twenty-six minutes were given to this test, which means that by the time the instructions were given, practically thirty-five minutes of the two hours had been taken by this one test. Not only does it take too much time to give, but it also requires a great amount of time to score. There were 97 problems in the four processes and although the answer card is made as convenient as possible, nevertheless it is bound to take more time than the results warrant in this particular kind of testing. Another reason is that given by some of our critics, namely that it tests one particular function under conditions which are not normal. The writers feel that some arithmetic test should be given and possibly the Woody scale in addition would satisfy the conditions. This could be easily graded as it is a scale and not a test. It is what McCall would term a power test and not a speed test. We feel that the reason for including some kind of arithmetic test might be termed a social one. We find in reading the newspapers, magazines, books, or any current literature, that a certain amount

of mathematical knowledge is needed. Not mathematics as such, but the interpretation of statements mathematically given. Addition, of course, does not take care of all these cases and indeed it would be difficult to even list all of them, but since we cannot give a long test to cover all the cases we feel that addition will come the nearest of any of the processes to fulfilling the conditions.

The highest correlation we were able to get between arithmetical speed and any other one test was .25. Bell, at the University of Texas, got an inter-test correlation of .20 between addition and alternatives. Simpson got a raw correlation of .79 between adding and hard opposites. King, at the University of Iowa, tested 56 freshmen engineers. He got a correlation of .75 for attempts or speed and scholastic rank. He got .48 for accuracy and scholastic rank. McCall used 88 6B pupils in New York City. He got an "r" of .20 for adding and school mark. His "r" for arithmetic was .30. His arithmetic test consisted of six selected examples, but details as to their precise nature are lacking.

Completion

We find the completion test one of the two tests in which less than 50 percent. of the boys reached or excelled the median grade of the girls. We also find the boys grades distributed over a wider range than the girls.

Correlations

	Girls	Boys
Completion with Speed	.22	.25
Accuracy	.16	.13
Opposites	.31	.79
Analogies	.46	.58
Information	.21	Neg.
Vis. Imagery	.06	Neg.
Log. Memory	.26	Neg.
Test Average	.60	.77
Uni. Grades	.22	.41

The lowest correlation among the tests for the girls was with visual imagery and we also find a negative correlation for the boys. The P. E. for these coefficients is about .026. As far as these coefficients can be used, it would seem that for a single test the completion is better adapted to the boys. Although they have three negative correlations with the other tests, we find they have a higher coefficient both with the average of all the tests and the average university marks.

McCall in *School and Society* for Jan. 6th, 1917, gives some coefficients which are of interest in this connection. His article is entitled, "Correlation of some psychological and educational measurements, with special attention to the measurement of mental ability." One of his conclusions is as follows: "Meaning by mental ability a composite of all the measurements, the omnibus and completion tests correlate with it 1. and .96 respectively. That is to say, a perfect measure of an individual by omnibus or completion would be a substantially true index of his mental ability." McCall's subjects were 88 6B grade public school pupils in a typical elementary school in New York City. For his completion test he used the Trabue language scale. McCall got a coefficient of .21 with arithmetic (adding), while our coefficient with Series B is practically the same, .22 and .16 for speed and accuracy respectively for the girls and .25 and .13 for the boys. His coefficient was .52 for teachers' marks while ours was .22 for the girls and .41 for the boys. The difference in the age and mental attitude of these two groups must be taken into consideration when any comparison is made. From our results we are not ready to recommend the completion test for use in judging the university student in as thorough-going fashion as McCall does for the sixth grade pupil when he says "The completion test will be a substantially perfect measure of his mental ability."

Bell found in his study of the freshmen at the University of Texas that the completion test showed the highest correlation of any of the test scores with the class marks. The writers found that for the boys two other tests correlated higher than the completion tests with class marks and two others practically the same, while for the girls, the coefficient for completion was next the lowest of any of the tests with class marks.

Dr. King found when he tested a group of 16 Juniors in the College of Applied Science and correlated the results with the combined judgments of three instructors in that department, that he got a coefficient of .35 between the completion test and these combined judgments. The judgments were given simply as to the ability of the men in question.

The writers' results show no important sex differences in the completion test. No reason is assigned for the girls making the better score, on the whole, than the boys.

Opposites

In the easier opposites we find only 41 percent. of the boys reaching the median for the girls, but in the harder opposites we find that 64 percent. reached the median for the girls. In order to obtain a single index for the opposites we added the scores made in each test and called that the score for the opposites combined. When we distribute those scores we find 54.1 percent. of the boys reaching the median for the girls.

Correlation

	Girls	Boys
Opposites with		
Speed	.03	Neg.
Accuracy	.01	Neg.
Completion	.31	.79
Analogies	.52	.77
Information	.24	.56
Visual Imagery	.07	.56
Logical Memory	.32	.38
Test Average	.51	.88
University Grades	.45	.84

We see from the above coefficients that the opposites correlate rather highly with all the other tests for the boys, but not so highly for the girls. We do find, however, that the opposites correlate the most highly of any of the tests *with university marks* for both boys and girls.

We believe that in giving both the easier and harder lists of opposites we obtain a measure which would not be possible by using only one of the tests. Following is the opening paragraph of an article in the JOURNAL OF EDUCATIONAL PSYCHOLOGY for October, 1916, by Irving King and Hugo Gold, of the University of Iowa.

"Among the various mental tests the test of ability to give opposites has found much favor with a number of investigators. Such tests are supposed, if the words are easy, to measure, in some degree, the rapidity of controlled associations reactions; if the words are hard, including such words as "unless," "suave," "ignorant," etc., the test measures in some degree logical keenness in selecting the word which will express most nearly the contrary idea."

Simpson says that the easy opposites is a good test for *readiness for controlled associations.* King got an "r" of .24 between hard opposites (two of Simpson's lists of 20 words each) and

ability of the students as ranked by the three instructors mentioned before in this article. In the case of the 56 freshmen engineers King got a coefficient of .26 for hard opposites and scholastic rank.

Waugh at Beloit College found a correlation of .84 between class standing and opposites.

Kitson, at the University of Chicago, found a correlation of .84 and .86 for the easy and hard opposites respectively, when correlated with the combined index of all his tests. These coefficients were obtained by the product-moments method. The coefficient, using the method of rank differences, as the writers did, was .53 when correlated with standings in the net score.

Kitson's word lists were very easy, his hard list being much easier than the writers' easy list. He defends the use of these easy lists by attempting to eliminate all words that are ambiguous. According to his opinion "these ambiguous words are productive of long pauses and incorrect responses because of conflict of impulses." This, it seems to the writers, is one of the things we are trying to test. Surely one who is able to make a quick, accurate, selective response has better mental ability than one who allows his mental attitude to be upset every time he is called upon to make such a decision. According to Kitson's results, 21 out of 40 made a perfect score of 100 percent. in the hard list, while 31 out of 40 made a perfect score in the easy list. Can we really compare these people when so many of them make a perfect score? If we are trying to determine the percentage of accuracy in that manner, then it seems it would be possible to select a still easier list or in other words, one of zero difficulty.

The writers take practically the opposite stand when selecting words for the opposites test. The answer card which we used was standardized to such an extent that it was fairly indicative of what the majority of the answers were likely to be. We feel that if we were to choose any *one* of our tests as a sign of the mental ability of the individual being tested, it would be this combination of the two opposites tests.

Logical Memory

Memory, perhaps, was the first function of the mind to undergo a test. Nearly everyone who has attempted to make a test

series has had in it some test which had to do primarily with memory. We used for our memory test a passage which was intended to test logical memory or memory for ideas in their logical order.

Correlations

	Girls	Boys
Logical Memory with		
Speed	.11	Neg.
Accuracy	.13	Neg.
Completion	.26	Neg.
Opposites	.32	.38
Analogies	.32	Neg.
Information	.31	.13
Visual Imagery	.31	.12
Test Average	.53	.65
University Grades	.35	.40

Simpson found a correlation between estimated intelligence and memory of words of .93 and memory of passages of .35.

Kitson found a correlation of .29 between logical memory and the net score of all the tests. This was for the forty students in the College of Commerce in the University of Chicago.

In the group of Junior engineers mentioned elsewhere, King found a correlation of .17 between logical memory and estimated intelligence. He found a correlation of .20 between logical memory and completion while ours was .26 for the girls and slightly negative for the boys. He found a correlation of .27 for logical memory and opposites, while ours was .32 for the girls and .38 for the boys.

The writers feel that some test of memory should be incorporated in any series of tests. There does not seem to be sufficient difference between the results of immediate and deferred memory to warrant taking the time to give both tests. If these tests are to be practical at all they must have the so-called mechanical features refined to such a degree that it will minimize the effort and economize the time of those concerned in both the giving and the taking of the tests. The test for immediate memory would be better than the deferred as far as the time factor is concerned.

Visual Imagery

We find this test to be the one in which the boys excel the girls score to the greatest degree. We find the range for each of the groups to be the same, namely, 0 to 100. There were

nine in each group that made zero. There were eight girls who made a perfect score while only five boys made a perfect score. We do find, however, that 68 percent. of the boys reached or excelled the median made by the girls.

Correlations

	Girls	Boys
Visual Imagery with		
Speed	.13	Neg.
Accuracy	.20	Neg.
Opposites	.07	.56
Completion	.06	Neg.
Analogies	.20	Neg.
Information	.23	Neg.
Logical Memory	.31	.11
Test Average	.72	.62
University Grades	.32	.21

Analogies

W. S. Miller, director of the university high school at the University of Minnesota, has probably done more than any other one person in using the analogies test. He gets a correlation of .79 with the analogies and class standing. He gave the tests individually, however, while ours were given in groups.

Correlations

	Girls	Boys
Analogies with		
Speed	.17	.04
Accuracy	.22	.18
Completion	.46	.58
Opposites	.52	.77
Visual Imagery	.20	Neg.
Information	.28	Neg.
Logical Memory	.32	Neg.
Test Average	.72	.74
University Grades	.14	.40

This is a test in logical relation. For some reason it has not found favor with those who have attempted to test college freshmen. The Binet-Simon tests for general intelligence and the Yerkes Bridges point scale use it, though only for adult measurements. It seems to the writers that these tests measure something that is not found in other tests used in this series, and that it would be a mistake not to include them in a series of tests intended for use with college freshmen.

Range of Information

We find 61.6 percent. of the boys reaching the median of the girls in this test. We also find a wider range among the boys,

the highest grade being 78, while the highest grade of the girls was 59. This test, as we gave it and scored it, is at best a sort of a guess affair, the only check being the definitions which the student was asked to write on the back of the sheet. It would be perfectly possible for the student to check each of the 100 terms and then happen to know the meaning of the first five, in which case he would get 100 percent. This case, while possible, is not very probable as is seen when we look at the median performance of these people and find it was only 25 words out of 100 for the girls and 28 for the boys. Unfortunately no one else has published any results of this test computed as ours were so that figures for comparison are not available.

Correlations

	Girls	Boys
Information with		
Speed	.06	Neg.
Accuracy	.13	Neg.
Completion	.21	Neg.
Opposites	.24	.56
Analogies	.28	Neg.
Visual Imagery	.23	Neg.
Logical Memory	.31	.13
Test Average	.60	.65
University Grades	.41	.44

The chief value of these tests lies in the supplementary light they cast in disciplinary cases. By means of these results the Dean of Women and the Adviser of Men were able to determine whether a student failing in his work, was failing from lack of mental ability or for other causes. Below will be given the records made by certain individuals. These are not typical cases, but are selected from among the best and the poorest records in the *mental tests*. It is noticeable that they have good and poor records in their academic work as well.

Case No. 1.

This is a boy who made the best record in his University work. He was the only member of his class of some 500 students who made four "A's." He is carrying English, German, Mathematics, and Zoology. He was below the median in the mental tests in only one test that being speed in arithmetic. He had an accuracy of 88 percent., but he attempted only 51 out of a possible 97. *His rank in his academic work was first while in mental tests it was sixth.*

Case No. 2. This is the record of a boy who had next to the best record in both mental tests and in his academic work. He received two "A's" and two "B's," his course being English, German, Mathematics, and Economics. He was above the median in all the mental tests and was able to complete all the 97 examples in the arithmetic test, being one of three in both the boys' and girls' groups to complete the entire list.

Case No. 3. This is the record of a boy who ranked first in mental tests and who received next to the highest grade in his academic work. He ranked first in the tests, although he attempted only 45 of the 97 examples in arithmetic and was only 65 percent. accurate.

Case No. 4. This is the record of a boy who made zero for his university work, although he took only two of the four examinations. He ranked 259 in mental tests out of 268 boys. He was above the median in only one test, that being range of information. He is a boy who was classed by those who examined him most carefully as below normal. He was in the hospital for some time, having adenoids and tonsils removed. Later a hernia operation was performed. This boy left home when he was 15. His father is a veterinary surgeon and from all indications the home environment was good. When he left home he went west, then served in the navy for four years. During that time he went around the world and naturally acquired a great deal of information the average boy of his age would not have. He was advised not to re-register for the second semester.

Case No. 5 is a boy who ranked 267th out of a possible 268 in mental tests and 234th in academic work. He also was asked not to re-register. The trouble with his academic work was ostensibly ill health, as he had 26 absences excused on that account. He came to the university with very poor preparation, and showed little resistance to distracting influences. He was a constant cigarette smoker, and was consistently reported by his professors as on the delinquent list.

Case No. 6 was a boy who ranked 258th in mental tests and 214th in his academic work. He was utterly lacking in initiative, had no ambition, and failed in all his academic work.

Case No. 7 was a boy who ranked 245th in the tests and 233d in academic work. His trouble, perhaps, is poor preparation,

as he is the fourth student to come to the university from his high school who had to be sent home on account of poor work. He was reported as delinquent from the very first. He was overwhelmed and showed no ability to adjust himself to the situation. He was asked not to re-register for the second semester.

Case No. 8 was a boy who ranked 253d in the tests and 234th in academic work. There was a distinct lack of preparation.

We were not able to obtain as much personal information about the girls as about the boys. The tests tend to pick them out, however, quite as accurately as the boys.

Case No. 9 is a girl who took first rank in the mental tests and also first in her academic work. There were seven girls who made the same grades in academic work, *viz.*, two "A's" and two "B's." This girl is seventeen years of age.

Case No. 10 is a girl who ranked second in mental tests and made the best grade in her academic work. She is sixteen, the youngest member of the freshman class. She has never been reported on the delinquent list and her work is of a generally high order.

Case No. 11 is a girl who ranked fourth in mental tests and received next to the highest grade in her academic work. She is an exceptionally strong student and has never been reported on the delinquent list.

Case No. 12 is a married woman who was the oldest member of her class. She ranked 276th in mental tests, the lowest rank. She left on account of illness before the end of the semester, but was doing failing work when she left.

Case No. 13 is a girl 20 years old who ranked 268th in mental tests. She failed in all her academic work and was asked not to register for the second semester. She was utterly lacking in ability, as she had tried the work the previous year and failed.

Case No. 14 is a girl who ranked 273d in mental tests, and failed in all her academic work. She also was doing the work the second time, and had been reported as failing from the start. She had tried a private tutor to help her with her work, but was simply lacking in ability.

Students Who Were Asked Not to Re-register

There were thirteen girls and fifteen boys who were asked not to re-register for the second semester on account of failing work

during the first semester. In each of these lists we find the median falling in the lower 25 percent. of the ranks in mental tests. The highest rank of those who were asked to leave was a girl who had an average of 13.3 points above the median for her class, and whose rank was 75. This girl failed in more than half of her academic work and was constantly reported to the Dean of Women as on the delinquent list. She was appealed to through her mental test record but to no avail. It was simply a case of too many dates with young men friends, and too many movies. She was perfectly capable, according to the testimony of the Dean, but her attention was on other things.

Distribution of Averages and Ranks of the Boys

	Mental Test Ave.	Mental Test Rank
Case No. I	3.3	111
II	1.2	126
III	.6	129
IV	— 7.6	164
V	—12.1	186
VI	—13.2	191
VII	—13.3	194
VIII	—13.7	199
IX	—15.2	206
X	—17.1	212
XI	—22.7	231
XII	—31.4	245
XIII	—32.0	250
XIV	—35.1	253
XV	—41.0	258

Total Cases 268
Range of Ranks in this Group 111—258
Median Rank 199

Girls

	Mental Test Ave.	Mental Test Rank
Case No. I	13.3	75
II	10.8	83
III	1.3	128
IV	— .1	142
V	— 3.3	162
VI	— 7.9	182
VII	—10.5	193
VIII	—11.2	199
IX	—13.8	208
X	—25.0	242
XI	—37.3	258
XII	—41.8	263
XIII	—45.6	268

Total No. Cases 276
Range of Ranks in this Group 75–268
Median Rank 193

Conclusions

I. This series of tests show fairly good correlations with academic work for the first semester.

II. Inter-test correlations show that we are testing a variety of mental functions.

III. Results show that this series, with the possible exception of the Courtis Arithmetic Test, Series B, is suitable for testing freshmen.

IV. These tests pick out those of poor mental ability much more accurately than those of good mental ability.

V. Certain mental tests would be valuable for colleges to use in dealing with disciplinary cases.

VI. The median performance of the boys slightly excels that of the girls in six of the eight tests.

VII. Sex differences in mental functionings are negligible as far as these mental tests are concerned.

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EDITORIAL

The War and Educational Measurements

The war is teaching us many things. It is teaching us, who have been the most spendthrift and extravagant people in the world, to economize. It is teaching us that big achievements do not spring into existence from filmy clouds, but have to be carefully prepared and wrought out. It is teaching us the supreme value of knowing how to do things. We have long had the reputation of being a practical people, and we have doubtless gloried unduly in our assumed practical genius. Now we are being brought to appreciate by bitter experience the need for scientific, organized knowledge, for highly trained, skilled direction, for the disciplined imagination of the specialist. But these things are not to be had for the wishing. They are the result of foresight, of careful planning, of a wise education.

We as a people have always proclaimed our belief in education. Our political leaders from Washington onward have seen in education the safety of the nation. But we have never taken the trouble to

scrutinize very closely what that education should mean. Now, under the pressure of war needs we are brought to test, to evaluate, to measure results. There is little doubt that our war experiences will bring about noteworthy changes in education. There will be a sharpening of definition in the aims of education, and a more insistent demand for tangible evidences of results from the methods employed in the process of education. Here lies the opportunity for the advocates of educational measurements. The aims of education are social, but they can and should be expressed in quantitative as well as qualitative terms. The methods of education are incidental to the personal relationship between teacher and pupil, but school procedure should eventuate in measurable attainments. The past decade has seen the development of a considerable number of scales and standards of educational measurement, but these have as yet found small place in the routine of the school room. Teachers and supervisors have been suspicious of the quantitative movement, and have held aloof from active participation in pupil measurements. The time is now opportune for a campaign of public enlightenment in regard to the instruments already at hand for the measurement of school attainments, and to the advantages that will accrue to the superintendent, the principal, the teacher, the pupil, and the public at large from their systematic use.

To this end increased effort will be made in forthcoming issues of the JOURNAL OF EDUCATIONAL PSYCHOLOGY to emphasize the practical values of educational scales and measurements. Articles recounting the use of these scales in school room procedure, with resultant diagnosis and treatment of individual difficulties will be especially welcomed. New scales and educational tests will be presented, and the correlation of these with other tests will be encouraged. The measurement of the intelligence of pupils by the Binet and other scales will receive attention as space permits, and studies showing the relation between intelligence ratings and the results of educational tests are invited. Experimental investigations of the learning process will be accepted, and special consideration will be given to those contributions which bear directly upon the work of the class room. In general it will be the policy of the JOURNAL to bring to the attention of superintendents, teachers, and the public the results of such scientific investigations as will increase the efficiency of our schools and make for higher standards of educational achievement.

J. C. B.

NOTES AND NEWS

The Bureau of Educational Measurements and Standards, of the Kansas State Normal School, Dr. Walter S. Monroe, director, has recently issued a series of diagnostic tests in arithmetic which will furnish perhaps the most complete information of a pupil's abilities in arithmetic of any of the tests devised for that purpose. The series contains twenty-one tests, arranged in four parts. Part I, tests 1–6, contains tests of the simpler aspects of the four fundamental operations. There are two addition tests, one single column, three digits, the other four column, five digits each; a subtraction test, a two digit number minus one digit; a multiplication test, a four digit number multiplied by a single digit; and two division tests, one short division, a four digit number divided by a single digit, and one long division, a four digit number divided by a two digit number. They are all speed tests, the time ranging from 30 sec. to 3 min. Part II, tests 7–11, contains a single column addition test of thirteen digits, a four digit by two digit multiplication test, a three and four digit subtraction test, a three by two digit multiplication test arranged with especial reference to the use of zero in multiplication, and a five digit divided by two digit division test. Part III, tests 12–16, presents tests in the addition, subtraction, multiplication and division of common fractions, each answer to be reduced to lowest terms. Part IV, tests 17–21, deals with the multiplication and division of decimals, the digits of the answer being given in each case, and the task being to put the decimal point in the proper place. The total working time for the entire series of twenty-one tests is 35½ minutes. The tests will be furnished to teachers and superintendents at cost, *i. e.*, fifty cents per hundred. If we had a series of tests in denominate numbers and another in percentage, the field of arithmetic would now be fairly well explored.

President-emeritus Charles W. Eliot, of Harvard, speaking on "The America of Tomorrow," asserts that America must be prepared for war for many years to come. He agrees with President Wilson in wanting the establishment of universal democracy, but to secure and maintain this the entire American people must be organized as a great army and navy based on universal training. This would mean a much more highly centralized control of public health, and of efficiency methods in the conduct of education. America must be made to realize how vital it is for the public welfare to have the intellectual productive capacity of each individual developed to its maximum. This involves an intensification and concentration of the learning process in all its aspects.

The application of mental tests to the soldiers in four camps of the national army has yielded such satisfactory results that the War Department has decided to extend the tests to all enlisted men and to all newly appointed officers. It is estimated that this will require a staff of 876 psychological examiners of all ranks for the 31 divisional training camps. In order to provide these (for there are probably not more than 100 psychologically trained examiners available in the entire country at the present time) a school of military psychology will be established at the Medical Officers Training Camp at Fort Oglethorpe, Georgia, in which selected men who have already had some work in psychology will be given intensive training in conducting group and individual psychological examinations, detecting mental incompetents, etc.

The department of psychology of Cornell University calls attention to the courses announced by the University in general, experimental and educational psychology, and in mental tests as offering special preparation for the position of psychological examiner in the army.

The University of Minnesota offers a special war course in methods of psychological examination in accordance with the suggestions of the surgeon general's department. The course is open to men over twenty-one who have had at least one year's work in psychology.

Owing to the fact that both Professor Watson and Professor Dunlap are engaged in war work, instruction in the department of psychology at the Johns Hopkins University has been discontinued for the current year.

Professor Lightner Witmer, of the University of Pennsylvania, has sailed for Europe to take charge of social service work under the direction of the American Red Cross.

Professor John W. Baird, of Clark University, was elected president of the American Psychological Association for the current year, and Professor R. M. Ogden, of Cornell University, and Professor W. F. Dearborn, of Harvard University, were elected members of the Council.

At the Pittsburgh meeting of Section L, Education, of the American Association for the Advancement of Science the following officers were elected: Vice-president, S. A. Courtis, Detroit; Secretary, Bird T. Baldwin, University of Iowa; Member of Council, Guy M. Whipple, University of Illinois; Member of Sectional Committee, Edward F. Buchner, Johns Hopkins University.

The Department of Superintendence of the National Education Association will meet at Atlantic City, February 25 to March 1.

PUBLICATIONS RECEIVED

WILLIAM HOWARD BATSON. *Acquisition of Skill.* Psychological Monographs. Vol. xxi, No. 3. Whole 91, 1916. Pp. 91. $1.00.

This extended study of the learning process grew out of Swift's work with ball-tossing. The experiments included ball-tossing, ball-rolling, picking shot from a rotating table by means of tongs, and releasing shot in a trough at such a moment that they would fall upon a designated portion of a rotating receptacle. Among the conclusions drawn from the experiment are the following: (1) The plateaus of learning depend upon the factors involved in the process to be learned and upon the distribution of attention. (2) The daily fluctuations are common to all types of learning and depend upon the objective and subjective factors involved. (3) The warming up process is the necessary accompaniment of all work where the ordinary daily activity does not provide the special preparation required for performing the work effectively. (4) A short rest period has no marked effect on work one way or the other. (5) After a long rest period the subject is found to be in a condition to improve very rapidly. In some cases the results show that the subjects have actually gained power during the rest period.

COSMOS. *The Basis of Durable Peace. A Series of Papers Written at the Invitation of the New York Times.* New York: Charles Scribner's Sons, 1917. Pp. ix, 144.

A well considered discussion of the conflicts of national interests underlying the war and a plan for an international guarantee of peace and the maintenance of order looking to the prevention of such a catastrophe in the future.

SIDNEY G. FIRMAN. *Progressive Lessons in English.* New York: D. Appleton and Company, 1916. Book I, pp. xiii, 289. Book II, pp. xv, 352.

These books are designed as guides for the language work in the elementary schools, Grades III to VIII. They contain carefully graded exercises for drill in the use of capitals, marks of punctuation, simple parts of speech, business forms, and those verb and pronoun constructions which are the sources of most frequent errors. Perhaps the second book leans too strongly to the illustration of principles in formal grammar to meet the tastes of the radicals in English teaching, but certainly no pupil who has worked through these two volumes, under the guidance of an intelligent teacher, would have any difficulty in avoiding the shocking errors which many of our high school pupils show.

A. P. M. FLEMING AND J. G. PEARCE. *The Principles of Apprentice Training, with Special Reference to the Engineering Industry.* New York: Longmans, Green and Company, 1916. Pp. xiii, 202. $1.20.

Part I deals with the place of the manual worker in industry and the economic importance of training to the individual, to the community, and to the state. In the second part the characteristics demanded from a worker by virtue of a manual occupation are set forth, and the extent to which these are developed by the existing educational system is discussed. The third part emphasizes the need for a means of careful selection of youths according to their vocational fitness and points to the extremely haphazard conditions under which boys at present enter industrial work. The fourth part is devoted to the consideration of artisan training. Existing methods in various industrial countries are described, and the underlying requirements of training stated, followed by the development of a plan suited to modern conditions.

H. W. FOGHT. *Rural and Agricultural Education at the Panama-Pacific International Exposition.* Bulletin 1916, No. 2. Washington: Bureau of Education, 1917. Pp. 112. 25c.

The bulletin gives a description and photographic illustrations of the exhibits supplied by the Bureau of Education and by the different states. There is also an account of rural education in Alaska and the Philippines and of various agencies that are operating to improve rural education and rural life.

Forsyth Dental Infirmary for Children. Second Annual Report. Boston: 1917. Pp. 31.

Significant in the work of this admirable institution is the establishment last fall of a Training School for Dental Hygienists. The course of study covers a period of twelve months and qualifies the pupils to operate as dental hygienists in the prophylactic treatment of the teeth, and to act as dental nurses in private offices and institutions. The infirmary treated over twenty-nine thousand cases in 1916.

The Fraser Budget for Personal or Family Expenses. New York: Tapley Specialty Company, 1917. Pp. 28. Seventy-five cents.

All cities and corporations are coming to realize the value of a budget, and in these days of enforced economy the same considerations apply to the finances of families and individuals. The author of this scheme has arranged the blanks so that each day's expenses are itemized on a single line, while one can see at a glance the total amount of any one type of expense for the month. At the bottom of the page are spaces for the totals, for the amounts alloted for the various items at the beginning of the month, and for the expenditures of the previous month. Thus one knows exactly where one stands at any time, and can determine where there is a possibility of retrenchment.

FRANK N. FREEMAN. *How Children Learn.* Boston: Houghton Mifflin Company, 1917. Pp. xiv, 322.

In spite of the recent experimental work in educational psychology the teaching of psychology to prospective teachers still remains in a most unsatisfactory condition. Examination questions set by examining boards, and the courses in psychology in normal and training schools still show the predominance of the old common sense, moralizing, faculty psychology, or else the dependence upon such texts of pure psychology as James, Angell, Titchener, or Pillsbury. One reason for this backwardness in the application of educational psychology has been the lack of suitable texts. The present volume will do much to fill this gap. The author's point of view is frankly behavioristic, and the learning process is regarded as the organization of responses. Beginning with a brief account of the nervous system as the basis of response, the author considers the relation of heredity and acquisition in responses, reviewing the work of Galton, Davenport, Woods, Thorndike and others, surveys the chief native responses of the child, analyzes the acquisition of skill, shows how perceptions and associations are built up, develops the principles of memorizing, and illustrates the processes of problem solving or thinking. There are good chapters on the development of language, and on the transfer of training. The book is a distinct advance over anything that is at present available, and deserves extended introduction into normal schools and teachers' reading circles.

JOHN LEONARD HANCOCK. *Studies in Stichomythia.* Chicago: The University of Chicago Press, 1917. Pp. v, 97. Seventy-five cents.

An investigation of the short single verse or double verse dialogue as used in the Greek drama, in Seneca, Mediaeval Latin, Early Italian, French and English, Shakespeare, and in the prose fiction of George Meredith.

WILLIAM HEALY. *Mental Conflicts and Misconduct.* Boston: Little Brown and Company, 1917. Pp. xiii, 330. $2.50.

A study of the causes of delinquency as revealed by an analysis of cases in the Chicago Juvenile Psychopathic Institute. Freud and his school have shown that the origins of mental disturbance frequently lie far back in the history of the individual and have been so repressed as to be quite beyond the patient's cognizance under ordinary conditions. While there is nothing Freudian about this book, there is a consistent effort to discover the causes of anti-social behavior in the previous history of the culprit. This results in uncovering serious and significant mental conflicts which at times cause such mental and moral disturbance that violent and criminal acts are committed

in the effort to secure relief. In these cases just as in the cases of disturbed mental equilibrium the task is first to uncover the cause of the conflict and secondly to reeducate the delinquent so that the mental conflict will not occur. Of course the ideal would be to secure such an education for each boy and girl that these conflicts would never arise. But parents and teachers will need to be much more highly trained in psycho-analysis before such a consummation is even approximated.

Hindu Mind Training, by an Anglo-Saxon mother. New York: Longmans, Green and Company, 1917. Pp. xxiv, 536. $3.50.

This is a curious and interesting book in which an intelligent and widely read mother interprets the Hindu system of mind training on the basis of modern educational psychology. The author has studied western systems of mind training from Rousseau to Montessori and has found none of them satisfactory. More recently she became familiar with the Hindu method, and finds therein much that anticipates the recommendations of leaders in experimental education. With Socrates the author holds that the great problem of education is self knowledge, and by the Hindu system this is made attractive by following the line of greatest connection in preference to the line of least resistance taken by European methods. The author ranges easily from Locke and Descartes to Münsterberg and Frank N. Freeman. Especially interesting is the Hindu version of vocational selection and guidance compared with Münsterberg's *Business Psychology*, and the Hindu moral training considered from the point of view of Holt's *The Freudian Wish*. While the term "mind training" itself suggests a point of view that is now considered antiquated by many psychologists and investigators, the examination of the stories and exercises used in Hindu education from the point of view of Titchener, Hollingworth, Ebbinghaus, and other modern psychologists leads to interesting if not all together convincing results.

F. J. Foakes Jackson. *Social Life in England, 1750 to 1850.* New York: The Macmillan Company, 1916. Pp. ix, 338. $1.50.

This is a series of Lowell Lectures delivered in Boston in March of last year. It is an authoritative account compiled from such sources as John Wesley's diary, the life of the poet Crabbe, the story of Margaret Catchpole,. reminiscences of Cambridge, the Creevey Papers, and accounts from the newspapers and periodicals of the time. The chronicle is of especial value in helping one to appreciate the social background of Dickens, Thackeray and Trollope.

Carl Kelsey. *The Physical Basis of Society.* New York: D. Appleton and Company, 1916. Pp. xvi, 406. $2.00.

This is an introduction to sociology by way of the relation of the organism to its environment, the facts of heredity, and the idea of evolution applied to human beings. The book is packed with sig-

nificant data for the understanding of the development of man under the influence of his physical environment. Among the topics treated are: Man in Relation to the Earth; The Struggle for Existence in Animal Life; Man's Control of Natural Forces; Man as a Product of Evolution; The Fundamental Doctrines of Heredity; The Development of Society Along Heredity Lines; Racial Mixtures; Sex Relationships; Social Relations and Population; Institutional Restrictions and Personal Initiative; and the Nature of Human Progress. It is a book that may well be taken as the foundation of one's educational theory and outlook upon life.

J. L. MANAHAN. *A Bibliography of Educational Surveys and Tests.* University of Virginia Record, Volume II, No. 3, 1916. Pp. xx, 47–92.

This extensively annotated bibliography is in five sections. Section I discusses articles dealing with the fundamental principles of educational measurement; Section II, school surveys; Section III, standard tests in school subjects, including arithmetic, handwriting, spelling, reading, composition and grammar, geography, drawing, algebra, and foreign languages; Section IV, studies in the application of standard tests; and Section V, tests of general intelligence. Teachers who are not familiar with recent educational investigations will find this summary very convenient.

CLARENCE WHITTLESEY MENDELL. *Latin Sentence Construction.* New Haven, Conn.: Yale University Press, 1917. Pp. x, 214. $1.50.

This is an important contribution not only to Latin syntax, but to the principles of sentence structure in general. In the introductory chapter the general psychological principles are outlined that underlie all sentence connection. These lead directly to the examination of the fundamental relations which language seeks to express. The remainder of the book is devoted to the results of investigations on the means employed by language to express these relations. The analysis discloses the extremely interesting structure of even the simplest expression of ideas.

EDWIN F. NORTHRUP. *Laws of Physical Science. A Reference Book.* Philadelphia: J. B. Lippincott Company, 1917. Pp. vii, 210. $2.00.

This is not a text-book in physics, nor is it a philosophical discussion of the constitution of the universe, but it is, as the title implies, a ready reference compendium of the most important laws that have been formulated by physicists. In each case the law is stated as succinctly as possible, brief explanations or formulae are given where these seem desirable, and there is a reference or two to standard works or to monographic literature on the topic. It should be a very helpful handbook to college students of physics.

JOHN CLYDE OSWALD. *Benjamin Franklin, Printer.* New York: Doubleday, Page and Company, 1917. Pp. xv, 244. $2.00.

This study of the "many sided Franklin" confines itself to Franklin's activities in the printing trade. The book contains many reproductions of title pages, magazine covers, catalogues, and newspapers. One of the most interesting of these is the title page to the first number of *Poor Richard's Almanack.* There is an account of Franklin's early apprenticeship, his efforts to get a start in Philadelphia, his partnerships, his experience as a type founder, and his public life as it was related to printing. There is a reprint of the first American cartoon representing the famous snake divided into thirteen sections with the legend "Join or Die."

RUDOLF PINTNER AND DONALD G. PATERSON. *A Comparison of Deaf and Hearing Children in Visual Memory for Digits.* Reprinted from the Journal of Experimental Psychology, Volume II, No. 1, February, 1917. Pp. 76–88.

The authors find that deaf children as a group have an abnormally poor memory span due to the lack of auditory experience. Lip readers are superior to manual readers on the average. No significant sex differences were found.

Report of the Commissioner of Education for the Year Ending June 30, 1916. Washington: Bureau of Education, 1916. Volume I, pp. xxvii, 692. Volume II, pp. viii, 663.

The statistics compiled in these volumes show that the number of persons enrolled in educational institutions in the United States is increasing at an average rate of half a million annually. This means that approximately 24 per cent. of the inhabitants of the United States are attending school as compared with 19 per cent. in Great Britain, 17 per cent. in France, 20 per cent. in Germany, and 4 per cent. in Russia. The nation's current educational expenditure is in round numbers one billion per year. The chapter on educational surveys by Prof. Edward F. Buchner, of Johns Hopkins University, gives a good account of recent undertakings in this field and will be of distinct help to many thoughtful school people. Another interesting chapter is that on educational hygiene by Dr. Willard S. Small.

Report of the 1915 Legislature Committee of the State of California on Mental Deficiency and the Proposed Institution for the Care of Feeble-minded and Epileptic Persons. Whittier, California: Whittier State School, 1917. Pp. 90.

This report contains extracts from the writings of Charles B. Davenport and Henry H. Goddard, an abstract of the work of Dr. Samuel C. Kohs on the *Distribution of the Feeble-Minded,* a summary

of the report of the New York Commission to Investigate Provisions for the Mentally Deficient, and articles by Lewis M. Terman and J. Harold Williams on feeble-mindedness in children of school age. The text of the bill to establish the new institution is given and there is a brief history of the movement to combat the evils of mental deficiency through legislative and moral prophylaxis.

Report of the School Survey of School District Number One in the City and County of Denver, Colorado. The School Survey Committee, 1916. Part I. *General Organization and Management*, by Franklin Bobbitt. Pp. 166. Twenty-five cents. Part II. *The Work of the Schools*, by Franklin Bobbitt and Charles H. Judd. Pp. 180. Twenty-five cents. Part III. *The Industrial Survey*, by C. A. Prosser and W. H. Henderson. Pp. 91. Twenty-five cents. Part IV. *The Business Management*, by J. T. Byrne. Pp. 108. Twenty-five cents. Part V. *The Building Situation and Medical Inspection*, by Lewis M. Terman. Pp. 75. Fifteen cents. *Supplemental Report on Organization and Administration*, by Ellwood P. Cubberley. Pp. 21.

The most interesting portion of this survey for the scientific student of education is Parts II, III, and V. In Part II compositions from the fourth to the eighth grades were measured by a scale devised especially for the purpose. The form and speed of handwriting were determined for each school and diagrams are presented to show the growth in high schools and the relation between high and elementary schools. In Part III we find a good discussion of retardation and elimination, of manual training in elementary and high schools, and of the place of drawing and design in vocational education. Part V presents statistics to show the inadequacy of the present school grounds and discusses seating, lighting, blackboards, heating and ventilation, and the general subject of school house-keeping.

JOHN J. SCHLICHER. *Latin Plays: For Student Performances and Reading.* Boston: Ginn and Company, 1916. Pp. vii, 213. Seventy-five cents.

Many educators at the present time believe that high school pupils should not be encouraged to spend their time on the study of Latin. All will agree, however, that if Latin is taught it should be taught in the most effective, interesting and stimulating manner possible. This little book contains seven Latin plays which are intended to be learned and acted by pupils. Two of the plays are closely connected with Caesar, two with Cicero, one with Virgil and one with Ovid. Interspersed in the dialogue are choruses and songs, the music for which is to be found at the end of the text. The progressive high school teacher of Latin will find this selection of plays of great value in keeping up the enthusiasm of pupils.

PAUL SHOREY. *The Assault on Humanism.* Boston: The Atlantic Monthly Company, 1917. Pp. 80. Sixty cents.

The publishers speak of this book as "an eloquent defense of the classical tradition against the attacks of President Eliot, Dr. Abraham Flexner, and the advocates of the 'new school.'" That it is clever, witty, facile, that it abounds in literary allusions skillfully handled, that it uncovers and mercilessly flays certain inconsistencies of statement must be admitted. But the author's brilliancy only serves to becloud and obscure the issue instead of clarifying it. For the question is not liberalism versus utilitarianism in education, but rather what constitutes a liberal education in this day and age. The classicists have no monopoly of liberal education. Indeed it is becoming increasingly evident that classicism represents an extremely narrow type of technical education. What is needed is a "new humanism," a return to the ideals of the Greeks and of the early Renaissance, a revaluation of educational values in terms of the present needs of humanity. All education is and must be utilitarian in that it meets some sort of human need. But the classical procedure defeats its own claim of being liberal. In the book much is made of the disciplinary value of classical study, and the medieval faculty psychology is stoutly defended. One cannot restrain a smile at the citation of "one of the best modern psychologies for teachers, the little volume of the eminent English psychologist Lloyd-Morgan," as conclusive authority for the acceptance of the faculties in psychology.

Sixty Second Annual Report of the Board of Education of the City of St. Louis, Missouri. for the year ending June 30, 1916. Pp. 639.

This report gives evidence of the growing demand upon school authorities to take the public into their confidence, and not only to tell them in a general way what is going forward in the schools, but to see to it that there are many things worth telling. The special features of this report are a tribute to the late Susan E. Blow, of Kindergarten fame, a series of graphs showing the average per cent. of failures in the several subjects in four high schools, and a detailed report by Dr. J. E. W. Wallin, director of the psycho-educational clinic, on the prevalence of mental and physical defects in school children. A particularly valuable feature of Dr. Wallin's report is the account of a census of speech defectives among the 89,057 pupils of the St. Louis Schools. There are extensive tabulations of the distribution of various types of speech defects and Dr. Wallin gives some excellent suggestions regarding corrective speech work in the schools.

JESSIE M. TATLOCK. *Greek and Roman Mythology.* New York: The Century Company, 1917. Pp. xxviii, 372. $1.50.

In this elementary book on mythology the author's aim is not to "write down" to children, but to present a simple, straightforward narrative of gods and heroes, couched in such terms as appeal to the

thoughtful, inquiring mind. The book is profusely illustrated with pictures of statues and other classic representations of Homeric characters. An appendix gives a brief list of poems and dramas based on the myths. It is an attractive book to own.

The Teaching of Government. Report to the American Political Science Association by the Committee on Instruction, Charles Grove Haines, Chairman. New York: The Macmillan Company, 1916. Pp. xi, 284. $1.10.

In spite of the fact that the teaching of citizenship is the defense most frequently offered for universal public education, it is generally admitted that most of the teaching of "Civics" is of a dry, formal, text-book nature, with little consideration or regard for the interests of the pupils. Recognizing and deploring this situation, the American Political Science Association in 1911 appointed a committee to make a careful and thoroughgoing investigation of the entire subject. The present volume presents the results of five years of labor on the part of the committee. Part I makes a survey of recent progress in the teaching of government, recounts various organized efforts to improve the instruction, and sets forth purposes, methods, materials, and devices. Part II deals with advanced civics in secondary schools, with some consideration of the training of teachers in this field. Part III presents suggestions for courses of study, with valuable bibliographies. Part IV discusses the teaching of political science in colleges and universities. In general the committee finds that the subject of government is neglected in most college courses and that the facilities for the training of high school teachers in this subject are sadly inadequate. An appendix of eighty pages summarizes the reports on the teaching of civics in elementary and secondary schools made by state committees in twenty different states. The book is a landmark in the teaching of the subject and will undoubtedly have a wide circulation and influence.

Third Annual Conference on Educational Measurements Held at Indiana University, April 14 and 15, 1916. Bulletin of the Extension Division, Indiana University, Volume II, No. 6, February, 1917. Pp 208 Fifty cents.

This volume contains stimulating addresses by Professor Ellwood P. Cubberley on *The Significance of Educational Measurements, Standard Tests in the Work of School Administration,* and *Measurements Applied to School Financing.* Professor Cubberley believes that the introduction of educational measurements will cause a much greater demand to be made on the superintendent and will call for distinct and adequate professional preparation for the work. The monograph also contains four addresses by Dr. B. R. Buckingham, educational statistician for the State of Wisconsin, in which he discusses *Efficiency Indices and Principles of Scale Derivation, with Special*

Application to Arithmetic, History, Geography, and Grammar. There are reports by Professor H. G. Childs on the *Cost of Instruction in High Schools, Enrollment, Acceleration, Retardation and Percent of Failures in High Schools,* and an important investigation of *The Measurement of Achievement in Algebra.* The latter is perhaps the most extended experimental study of the subject that has yet been published.

EDWARD L. THORNDIKE. *English Composition.* One Hundred Fifty Specimens Arranged for Use in Psychological and Educational Experiments. New York: Teachers College, Columbia University, 1916. Pp. 127.

These specimens of English composition will furnish material to determine the ability of prospective teachers to evaluate compositions; to test for individual, class, and sex differences in complex judgments; to determine the amount of transfer of improvement by practice; to detect constant errors in judgment; and to demonstrate and measure the value of objective scales. The general merit of each composition has been determined on the basis of the Hilegas Scale by a consensus of from 23 to 100 judges. These values are given in two tables at the beginning of the monograph and are only to be referred to as a check on the experimental use of the specimens.

W. TROTTER. *Instincts of the Herd in Peace and War.* New York: The Macmillan Company, 1916. Pp. 213. $1.45.

"The general purpose of this book is to suggest that the science of psychology is not the mass of dreary and indefinite generalities of which it sometimes perhaps seems to be made up; to suggest that, especially when studied in relation with other branches of biology, it is capable of becoming a guide in the actual affairs of life and of giving an understanding of the human mind such as may enable us in a practical and useful way to foretell some of the course of human behavior." The psychology here referred to is rather a type of speculative sociology and rests upon the very questionable concept of instinct. The author's theory of gregariousness is developed in the first seventy pages and the remainder of the book is devoted to an analysis of the social forces involved in the present war. While we may not agree with the author's psychology, the discussion of the English and German social attitudes toward the war makes very interesting reading.

Value of the Classics. Princeton: Princeton University Press, 1917. Pp. vii, 396. $1.50.

The classicists are on the defensive. Their backs are to the wall. They feel the necessity of calling out all their reserves to meet the increasing pressure of educational criticism. Accordingly a great classical rally was held at Princeton last June, and expressions of loyalty and support were secured from as many of the faithful as

were believed to have influence with the public. This volume presents the results. The editor, Dean Andrew F. West, of Princeton, introduces the book with the following words: "In education definite evidence is worth more than theorizing." (This sounds promising. "Definite evidence" is what many of us are ardently seeking.) "This book is chiefly an appeal to facts, and two classes of facts appear in its pages. The first includes . . . the statements of nearly three hundred competent observers representing the leading interests of modern life and including many of the highest names in our land. . . . The second part is statistical. The most pertinent and reliable facts in the records of our schools and colleges, so far as procurable, are here presented and examined." Thus it is seen that the facts of the first class are mere opinions. That opinions are facts —very stubborn facts—the history of civilization amply reveals. But that they constitute "definite evidence" would be accepted chiefly by those whose critical judgment has been warped by the "formal discipline" of classical training. The facts of the second class are limited to a few pages of statistics from the reports of the bureau of education and the college entrance examination board. If this is the best the classicists can do, they would seem to be in a precarious position.

WILLIAM A. WHITE. *Mechanism of Character Formation: An Introduction to Psychoanalysis.* New York: The Macmillan Company, 1916. Pp. vii, 342. $1.75.

The author emphasizes the genetic approach to the subject of character construction and bases his argument largely on the biological work of Marshall and Loeb. In the next chapter however, he dives into the abyss of the unconscious, and from there on we meet the usual Freudian phraseology of the libido, conflict, symbolism, dream mechanisms, the family romance, and the resolution of the conflict by suggestion and re-education. The book is characterized by much greater sanity than many of the Freudian productions. As Professor Watson has recently pointed out, there is the ever present danger in this type of discussion of laying undue stress on a system of verbal concepts, which seem to mean something to their users, but which lead to a crude, mystical, anti-scientific, vitalistic attitude toward fundamental problems. The movement has done some good in turning the attention of medical men to psychology, but there is great danger that the verbiage of its terminology may lead to a stultification of rigid, accurate, scientific thinking.

WILLARD HUNTINGTON WRIGHT. *The Creative Will. Studies in the Philosophy and Syntax of Aesthetics.* New York: John Lane Company, 1916. Pp. 288. $1.50.

This is a sententious disquisition on the significance of art. Form is the basis of all beauty, and aesthetic form must reflect the form

which is most intimately associated with our sensitivities. The artist cannot go to the science of aesthetics to learn how he may produce beauty. Creation in the arts is the result of some impetus received either from objective nature or from a mental process. The second and most extensive part of the book deals with problems of aesthetics while the third and fourth sections treat of art and the artist, and art and the individual.